

How Information Technology Can Enable 21st Century Schools

BY TED KOLDERIE AND TIM MCDONALD | JULY 2009

The key contribution of IT to education is that it can allow the student's interests, needs, strengths, and weaknesses to drive the learning process, with the instructor facilitating rather than dictating.

In recent years, the information technology (IT) revolution has transformed American industry—leading to new types of work processes and business organizations, and increased productivity and consumer innovations—but by and large, this game-changer has bypassed America's schools. Virtually all K-12 schools in the country are connected to the Internet, and the student-to-personal computer ratio has declined steadily. Unfortunately, however, IT has been limited to reinforcing—albeit improving—existing modes of teacher instruction rather than transforming them. This is not good enough. America's K-12 education system not only is failing to educate most students well, contributing to a decline in U.S. economic competitiveness, but is increasingly not financially viable.

Fortunately, IT has the power to dramatically remake American schooling, raising performance while potentially simultaneously cutting costs.¹ This report discusses why the existing school reform movement has stalled, how IT can enable the emergence of fundamentally new kinds of schools, particularly middle and high schools, and what the states and the federal government need to do to drive the emergence of these new ways of educating our nation's future generations. In particular, we believe that

IT is enabling the emergence of a new kind of pedagogy that is focused on meeting the needs of individual students (“mass customization”). This IT-enabled approach would mark a departure from current pedagogy in which all students are treated more or less alike (“mass production”).

To drive this kind of fundamental pedagogical reform in the direction of “mass customization,” we believe that the federal government and states should do the following:

- **Each state should establish a state-level *NewSchools* entity for innovation, with the power and authority to realize a program of school innovation enabled by IT.** Modeled after a recent initiative in Minnesota, a state-level *NewSchools* organization would be established as a 501(c)3 non-profit to raise and direct public, as well as private, resources, to spur innovation in the application of pedagogy to middle and high schools.
- **The Obama Administration should become a champion for school redesign and the creation of *NewSchools* authorities.** By championing a vision for school redesign, emphasizing that incremental innovation is no longer sufficient to get the schools our country needs, the Obama Administration can encourage states to innovate.
- **Congress should create a *NewSchoolsAmerica* Fund** to encourage state legislatures to create these specialized organizations that are autonomous from the management of traditional schools.
- **Congress should allow new innovative schools to be evaluated outside the framework of the federal No Child Left Behind Act (NCLB).** NCLB reflects the traditional conception of schooling, in which standardization and assessment are considered the primary levers of incremental improvement. The innovation sectors of public education—in the chartered schools and school districts—do not fit well into this traditional paradigm. Congress should allow exemptions and adaptations to state and federal course and content requirements. Alternative modes of assessment, as funded by foundations or state innovation authorities, must have room to gain legitimacy.

There is a unique opportunity for federal and state policymakers to change the direction of our country's K-12 system. The demand for change is mounting as people see that it is possible to do things differently. The supply of new ideas is growing as educational entrepreneurs are designing new models of school. Increasingly, Americans understand that our education system is no longer a beacon but in fact a liability. Fortunately, with IT-enabled innovation, there is a strategy

for educational reform that promises to move beyond incremental reform. As background, it is important to first understand why educational reform efforts to date have seen such limited gains.

I. LIMITATIONS OF K-12 EDUCATIONAL REFORM EFFORTS TO DATE

States have been focusing on improving K-12 education for more than two decades, but they have been doing so on the faulty assumption that the problem to be addressed is a “performance problem” that can be solved by pushing the existing educational model to do better. Over that period, two approaches to educational reform—standards-based reform and chartering schools—have in different ways been trying to generate better schools.

It is time to consider that the failure to improve learning might lie precisely in the assumption that the problem is one of performance to be solved by pushing the existing model to do better. Rather, we have instead a design problem—a need for radically different forms of schooling that can better educate the majority of students who, relative to their potential, are underachieving in the factory model of school.

The principal means for trying to improve educational performance in recent years has been standards-based reform. Initially designed in 1990, standards-based reform was based on the idea that school districts would respond to the call to improve as “objective” standards highlighted progress or lack thereof. When states did not improve or did not improve as much as was expected, policymakers became impatient and moved to “require” improvement through steps such as the federal No Child Left Behind Act, which imposed sanctions on schools that did not improve as much as was expected.

Another major educational reform effort has been the charter school movement, which emerged first in Minnesota in 1991 and has since spread in one form or

another to 40 states, plus the District of Columbia. Unlike the standards movement, the charter school movement was an institutional innovation that departed from the traditional district arrangement of K-12. As originally conceived, chartered schools could be created and run by—even authorized by—entities other than local boards of education. Laws enabling chartering made different schools possible by opening the way for less-regulated and more autonomous schools; however, these laws did not themselves innovate with forms of schooling. Chartering is a platform on which schools of various kinds could be built. A chartered school is not a kind of school in any pedagogical sense. Unfortunately, too many chartered schools have simply replicated the pedagogy of traditional schools with the predictable lack of improvement.²

Conventional school is like a school bus rolling along the highway, with the teacher standing at the front and pointing out interesting and important sights but telling the passengers that, no, we cannot let you get off to explore what's down that side road.

To be sure, some progress has been made through standards-based reform and chartering schools. Standards, supplemented by assessment and the introduction of some consequences for non-performance, have begun to move up the proportion of students proficient with basic skills. Chartering has proven unexpectedly popular and now represents more than 15 percent of public enrollment in a number of larger cities. In Minneapolis, for example, enrollment in chartered schools has grown at an annualized rate of 30 percent over the past 10 years. Like school choice, it now appears to be a permanent part of the K-12 system.

Yet most people remain disappointed in the pace of progress and believe that more is needed and possible. The disappointment comes in part because the trend lines for educational improvement are so flat. High schools are unable to retain approximately one in three students to graduation.³ And nearly half of the high school dropouts point to boredom and lack of interest in classes as a reason for leaving school. This comes as

no surprise; most students have little choice in what and how they learn. This is because the educational system is standardized with an increasing number of curriculum requirements and must, by design, ignore individual needs and interests of students.⁴ In fact, the premise is that student interests and individual learning styles and strengths are at best secondary to the education process.

Moreover, the students who do graduate from U.S. high school are not well prepared. In one survey, firms reported that 60 percent of applicants with a high school degree or GED were poorly prepared for an entry-level job.⁵ Respondents to a Conference Board survey rated high school graduates as “deficient” in 10 skills—including written communications, critical thinking, and teamwork—and excellent in no skills. Only about half of high school graduates have the reading skills they need to succeed in college, a rate that has not changed in 10 years.⁶

In a survey of international student assessment in 2003, the United States ranked 24th among 41 nations in math performance among 15-year-olds.⁷ Moreover, notwithstanding the widely held view that American higher education is the best in the world, there is evidence that the performance of U.S. colleges and universities in educating students has not kept up with the demands of the global economy.⁸ Strikingly, just 34 percent, 38 percent, and 40 percent of recent graduates of four-year colleges or universities were proficient in prose, document, and quantitative literacy, respectively—all skills that should be mastered in high school.⁹

The disappointment in the pace of educational reform also comes in part from a sense that in our changing world the improvement is outpaced by the need for improvement; education is “running faster only to fall further behind,” as some say. High school especially remains a major puzzle, with proficiency low, with gains in the elementary years falling off in the upper grades, and with large differences still in knowledge, skills and graduation rates between racial groups.

To some, the situation with respect to U.S. education represents a failure of will. The country is not serious about improvement; if it were, it would make

educational standards even higher and courses even harder—as if tightening the status quo were the logical response to obsolescence. If the country were serious it would increase financing for K-12 education and pay teachers more. But funding alone cannot be the fundamental problem. Inflation-adjusted per-pupil spending in the United States has more than doubled in the past three decades from \$4,060 per pupil in the 1970/71 academic year to \$9,266 in 2005/06. Between 1994 and 2004, average inflation-adjusted spending per pupil increased 23.5 percent and from 1984-2004 real spending rose by 49 percent.¹⁰

Concerns over funding, while legitimate, are a diversion from the real and more difficult challenges of education reform. Many of the efforts at K-12 educational “reform” efforts in the United States have been less about reform than about getting traditional schools to perform better—usually by making them do what they are doing now, only harder, longer, and with more added-on. More tests. More homework. More math. Less recess. Fewer art and music classes. A longer school day.¹¹ A longer school year.

Ever since the publication in 1983 of the prominent report *A Nation at Risk: The Imperative for Educational Reform*, the United States has been pressing its schools to do better.¹² Standards and assessment and accountability have been introduced, professional training has been stepped up, and financing has been increased. The “improvement industry” at work on this job is enormous: countless individuals and organizations researching and publishing; speaking, writing and consulting; conducting professional development; and advising and exhorting districts and schools to be better. With all this effort, over so long a period of time, why has there not been more success in improving schools and learning?

It is time to consider that the failure to improve learning might lie precisely in the assumption that the problem is one of performance to be solved by pushing the existing model to do better. Rather, we have instead a design problem—a need for radically different forms of schooling that can better educate the majority of students who, relative to their potential, are under-achieving in the factory model of school.

II. THE NEW OPPORTUNITY TO USE A MASS CUSTOMIZATION MODEL FOR SCHOOLS

Most of the effort to improve American schools takes the existing model of education as a given. The existing “mass production” model of education—named after the similar model of production that predominated in most U.S. factories until the rise of IT-enabled flexible production systems in the last decade¹³—looks little different than it did 100 years ago.

The mass production model in American education has several features:

- School is defined in time, in space, and in its form of organization. A traditional school is a building to which children come for certain years of their lives, months of the year, days of the week, and hours of the day. There they are grouped by age into “grades” to be instructed by adults.
- The school itself is not a discrete organization but a unit of a larger organization that owns its facility, employs its teachers, provides its revenue and sets out its method of operation and designs its curriculum. The teachers, unlike professionals in many white-collar occupations, are not in charge of the administrators but work for the administrators.
- Schooling, the process of learning, is conceived of as instruction. Learning is thought of as the effect of teaching; it is quite common to hear people talk about “delivering education.” Indeed, school is designed around the adult, not the student. Young people sit in desks, in rows, while an adult imparts information. There is limited, if any, opportunity for customization or personalization of the learning process as student interests are treated as largely irrelevant to what “has” to be taught.
- Adolescents study disciplines disconnected from their lives—English, history, civics, physics, and mathematics. Their studies are divided into courses, most of which are required for all students. Courses are taught in classes, with teachers instructing 25, 30 or more students who move week by week through the subject and chapter by chapter through the same text. The idea is for teach-

ers to cover and students to master the particular subject matter of the course rather than the generic transferable skills (e.g., the ability to analyze and to solve problems, to comprehend complex situations, to think critically, to be creative, to be adaptable, to work with others, and to learn and re-learn over a lifetime). The assumption is that all students will know all subjects. Secondary students are tested mainly on their ability to recall factual knowledge. Success is defined as scoring well on tests for that knowledge, most involving testing for discrete, right-or-wrong answers.

- Conventional school is like a school bus rolling along the highway, with the teacher standing at the front and pointing out interesting and important sights but telling the passengers that, no, we cannot let you get off to explore what's down that side road. As a result students who want to pursue their interests and passions must do so on their own time and energies, if after completing all the required homework they have any left.

In industrial organization terms, the model of educational production just described is termed “batch-processing.” Batch-processing refers to a production process in which batches of items (e.g., specialty chemicals or biologic pharmaceuticals) are processed in a standardized way, each going through the same processes collectively and sequentially.

When applied to education, batch-processing has obvious limitations. It requires all students in the class to proceed through the full term and at the same pace, affording little opportunity for those who need more time to take more time and little opportunity for those who could move faster to move faster. In the typical mixed-ability classroom, this confronts the teacher with a difficult, almost impossible, task. Moreover, educational course and content requirements too often tie the hands of students who want to pursue different or more sophisticated curricula. Four years of English is not inherently superior to two years of English and two years of philosophy or two years of journalism, but in almost no American high school today does the student have a choice.

Traditional schools do not easily permit students who develop a particular interest to pursue that interest, no matter how strong the motivation or how useful the

learning that might result. The pursuit of individual interests has become even harder as states have added more and more required courses to the high school curricula, slowly squeezing out electives. Alternatives sometimes exist for special-needs students and for those “not doing well,” but the batch production model of education makes addressing the needs of these students expensive and still not very customized. For mainstream students and more talented students, there is not much in the way of alternatives.

Four years of English is not inherently superior to two years of English and two years of philosophy or two years of journalism, but in almost no American high school today does the student have a choice.

Is it any wonder then that so many young people drop out, with many of the students who stay doing so only because they see the link between putting up with a relatively unengaging process now for rewards later in life stemming from a high school diploma? Yet we carry forward almost unquestioned a batch processing model of school and teaching not designed to motivate either students or teachers. Instead of innovating to find new approaches, we try to improve performance by pushing ever harder to standardize and perfect the old technology of textbook and teacher-instruction.

America's traditional educational models did not just arrive out of whole cloth or even solely reflect pedagogical theories of the day; rather, they were a direct result of the technology of education in existence at the time. Indeed, they reflected the economics of scarcity that until quite recently imposed themselves not just on information industries (film, music, television, books, newspapers and magazines) but on most industries. Until the IT revolution of the last decade, it was not economically feasible to produce customized products or services.

In the old economy, scale was essential. The old economy was a mass production economy where the underlying technology system limited product and service diversity. Moreover, changing factory-floor production technology usually took skilled labor many days or even weeks. Dedicated machines that could only do

one thing (e.g., stamp out a particular car door) had to be taken down and replaced with a new one that could do something different. The situation was not much different in offices. Changing software on mainframe computers required software engineers to reprogram complex and expensive proprietary software systems.

The education sector paralleled other sectors of the old economy. It was not economically feasible to provide a teacher for every child, to place a library in every home, to provide a unique textbook for every student, or to erect a high school in every neighborhood. Thus, school developed as a place to which students come to be grouped into classes and instructed together with the same texts before moving on to next phase of the production process—their next class. And because the adult and books were the only sources of information for youth, the only possible pedagogy was teacher-led, uniform instruction.

Instead of innovating to find new approaches, we try to improve performance by pushing ever harder to standardize and perfect the old technology of textbook and teacher-instruction.

The current batch-processing model of K-12 education owes its ascendance largely to expedience, not any pedagogical superiority. It is not necessarily the most effective model, but it is the model that was the most cost-effective given the existing technology of the time: paper, books, pencils, and chalk boards. Today, however, IT is enabling organizations of all kinds to move from mass production to mass customization.¹⁴

Using IT, companies can develop flexible factories and offices and expand the variety of their products and services at little additional cost. Factories have embraced such new practices as “lean production” and “just-in-time” inventory to enable greater customization. Lean production enables companies to decrease batch sizes, reduce set-up times, shorten cycle times and manufacture an increasingly greater variety of products in an efficient, cost-effective manner. With the capability to produce more products in smaller quantities, companies can offer mass customized products at close to mass production costs. The key

to successful mass customization in industry is computer-controlled machinery that can be easily modified through changes with the software and can easily produce different products or services. Computer companies like Apple, Dell and HP, for example, use a flexible production process to configure each computer they sell to meet the needs of individual buyers. Though it is sometimes more expensive to make customized products, with IT the price in many cases is the same as with mass production.

Moreover, IT-driven customization is not confined to manufacturing; it is prevalent in the service sector. The mail-order pharmacy Medco can process tens of thousands of different prescriptions every day because of IT-enabled “smart” production lines that fill, package and get ready to mail individualized purchases but with mass production efficiencies. And of course, the Internet itself, with its customized e-commerce and e-content, is the epitome of mass customization, with lot sizes of one.

Now IT that allows the use of new pedagogical technology is making it possible for American schools to move in the direction of mass customization. Applied to education, IT can produce models much more motivating for young people who are already customizing much of their lives. A Teacher of the Year in Minnesota caught it perfectly: “Only individualized education can leave no child behind.”¹⁵

If the kind of achievement America needs from its students requires effort, and if effort depends on motivation, then it is vital to move from the old mass production model of schooling to a model that engages individual students by offering them the opportunity to personalize their work and to pursue the interests they develop. This change could be hugely important to the effort to retain students, to get them to complete school and to get them to do serious and quality work that will in turn give them the skills and knowledge they need to contribute effectively to society.

The ability to tailor educational programs to individual students also can ease the difficulty boards of education face today when obliged to introduce a new approach—say, to teaching math—uniformly district-wide, where students differ and where some students (and parents) inevitably will resist.

III. OLD VS. NEW TECHNOLOGIES AND SCHOOLS

Now that IT makes mass customization (and personalization) possible, we need to work it into the classroom. Modern IT—including software, hardware, and communications technologies—enables this new form of pedagogy to be applied cost-effectively. In the traditional model of schooling, an adult teacher does the laboring with the capital consisting of the school building, the desks, the chalkboard, the books, and so forth. In traditional educational settings, students do not spend much time on computers. Adding the latest devices to such settings in many instances has simply supported the existing teacher-led pedagogy and has not actually changed the way the classroom operates. One study found that even in American schools with fewer students per instructional computer than the national average, students actually use computers for only about 2 percent of the possible time in a day.¹⁶ Still, although there is conflicting evidence of the effect of computers on education, several recent overarching reviews have documented that teaching with technology in the classroom does enhance conventional education, constituting an improvement over traditional instruction.¹⁷

The new technology of education—where students use IT fluidly for mass-customization to personalize student learning—can produce even stronger results. Using IT to personalize learning enables and empowers young people to pursue their own knowledge. This application of capital—the use of IT to make possible new and better ways of student learning—is described as type 2 learning.¹⁸ Type 2 learning puts the student at the center of the learning process by emphasizing active participation by learners, who control the pace of instruction and construct knowledge by themselves.¹⁹

Type 2 learning harnesses technology in ways that inspire students to learn and conduct their own inquiries outside of the framework of traditional classes and standardized tests.²⁰ The key contribution of IT is that it can allow the student's interests, needs, strengths, and weaknesses to drive the learning process, with the instructor facilitating rather than dictating. It allows materials to be designed much more around the needs of individual students. In this sense, IT can reengineer the “production process” of school—the learning—by placing students at the center of activity. This stands in contrast to the adult-driven pedagogy in which the

teacher controls information. What are needed now are pedagogical applications of hardware and software that maximize the ability of young people to control information technology and to use it creatively. This entails a new paradigm of student learning, overseen and assisted by teachers. Some of those thinking and writing about its potential have a nice phrase for it: “Technology-mediated learning.”²¹ With this approach, students are empowered to vary the pace at which they learn—more slowly if necessary, more rapidly if possible—and vary what they learn.

Teachers benefit, too. This approach can produce a form of school that upgrades teachers' work from presenting material to planning, advising, and evaluating. Under this production model not only do young people assume a greater share of labor, but the entire operation of the classroom is fundamentally altered. It is not sufficient for students to sit passively in desks while the adult works to impart knowledge. Young people must be less restricted, less regulated—yet guided.

By redesigning schools to incorporate new technologies, we can dramatically increase the personalization of American education with little marginal increase in labor costs. The prospects of this change are revolutionary for an industry that spends upwards of 80 percent of its operating revenue on personnel. Hiring twice as many teachers is prohibitively expensive, but the right application of new technologies may achieve a similar result.

Examples of Type 2 Learning in Practice

Progress in American education depends on finding new forms of school and schooling—and, in particular, on moving education from the traditional mass production model to a mass customization model. In addition, schools must focus more on developing students' skills and less on requiring students to master any particular academic content.

IT is playing a key role in enabling these new teaching methods. Technology-mediated learning can take the form either of technology-enhanced coursework (including online courses) or of project work. Online virtual schools are already altering significantly the old notion of school as being a place fixed in time and space. Personalized tutoring software can help

students master material at their own pace. Learning management systems enable teachers to set up a framework of lessons but let students pursue them as they see fit.

One promising approach which both more closely resembles real-world work and is often more intrinsically interesting to students, is project-based learning. The focus in project-based learning is on letting students learn in areas that interest them (so long as they fulfill content requirements) rather than on “teaching” every child the exact same information. The resources available today for project-based learning are considerable and are developing rapidly as Internet-based content grows and as search engines make them accessible.²² Next-generation broadband-enabled networks make it possible for students to team up with others, including professionals, elsewhere.²³ Hand-held mobile devices make it possible both to study lessons and to communicate with partners and teachers from remote, off-site locations.

A leading example of project-based learning is Minnesota’s New Country School, located in the rural town of Henderson in southern Minnesota. New Country School is a teacher-run cooperative chartered school with a project-based pedagogy. Each student has his own workstation, complete with a desk and a personal computer. Students work with advisors to achieve course content requirements. They can incorporate IT in any way they see helpful: email, podcasts, online specialty courses, personalized tutoring software, and document software that lets teachers jointly review work. Minnesota’s New Country School describes itself the following way:

The school is based upon the idea that students will be most engaged in the learning process when they have a personal interest in what they are learning. Instead of sitting in a teacher-driven classroom all day long, students learn through the exploration of topics that interest them on their own terms, and largely at their own pace. Each student is a member

FIGURE 1. OLD VS. NEW MODELS OF SCHOOLING AND LEARNING

Old Model	New Model
Reform existing schools	Create new schools
Larger schools	Smaller schools
Delivering education	Students learning
Read books, listen to talk	Explore the Web
Time-bound/place-bound	Any time/any place
Technology as textbook	Technology as research
Groups, classes	Individualized
Time is fixed	Time is variable
Standardization	Customization
Cover material	Understand key ideas
Who and what	Why and how
Know things	Apply knowledge
Tradition	Relevance
Over-reliance on multiple-choice tests	Written/Oral demonstrations
Testing for accountability	Testing for understanding
“Make ‘em”	“Motivate ‘em”
Instructors	Advisers/facilitators
Teachers serve administrators	Administrators serve teachers
Administrative management	Professional Partnership
Adult interests dominate	Student interests dominate

of a team of twelve to twenty students, managed by an adult advisor who helps to facilitate the learning process. Instead of grades, students receive credit for their work. The process is completely flexible, and can be tailored toward specific learning styles, prior student knowledge, student motivation, etc.²⁴

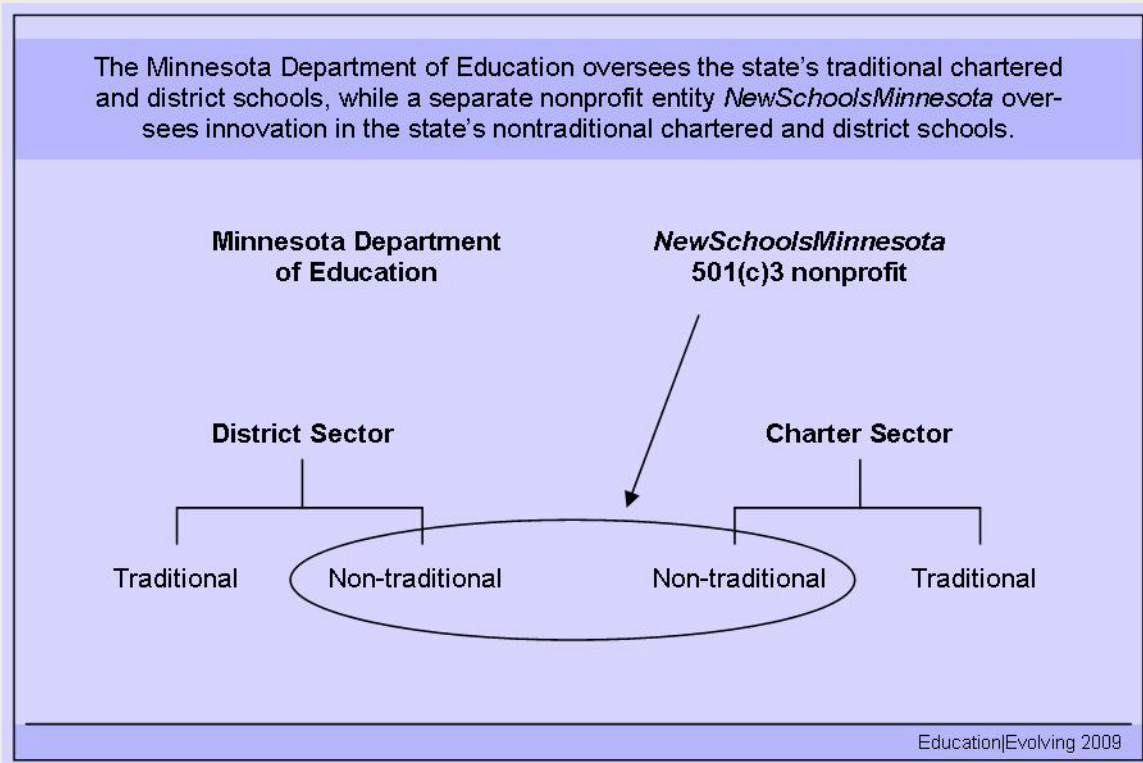
Another model is the School of the Future, in Philadelphia. In a public/private partnership, Microsoft Corporation teamed with Philadelphia Public Schools to design a school that, while within the district's budget, could make IT ubiquitous in the school.²⁵ By easing restrictions on structured courses, the school approaches the new technology of learning by motivating kids to pursue their own learning under the guidance of an adult. Some of the advances are type 1, such as smart cards that ease administration (and let the learners open their lockers without a key or combination), but others get to the very foundations of how students go about acquiring information and turning it into knowledge.

In short, incremental changes to the traditional batch-processing model of education in the United States are not sufficient. We need new models of education, enabled by and designed around information technologies. Although there is no silver bullet for school improvement, a program of educational innovation that relies on IT to place students at the controls of their own learning is the best structural approach to move toward raising achievement. The reason is that this approach is rooted in the intrinsic forces of motivation and engagement. Figure 1 gives a sense of the potential of new models of education built around IT by contrasting the new paradigm with the old.

IV. STRATEGIES FOR IMPLEMENTING IT-ENABLED SCHOOLING

Implementing IT-enabled schooling requires a strategy. Much of what now goes on with respect to education in Washington and state capitals—the research, the policy, the politics—operates on the faulty assumption

FIGURE 2. MINNESOTA'S STRATEGY FOR K-12 INNOVATION



that the school model we have been using for the last 100 years is the only model and/or the best possible model. Decades of time, effort, and attention have been devoted to well-intentioned educational reform efforts built upon this faulty premise.

The responsibility for public education in the United States rests with the states. Thus, effective innovation in the schools will have to occur school by school and state by state. It is important that schools be able to design themselves, from the ground up, around IT. This means establishing new schools specifically designed for technology-enabled innovation. Innovation is not limited to the creation of charter schools. School districts can increasingly play a role in such innovation, and teachers, if empowered, can be among the primary agents of innovation, as well.

Perhaps the single most important thing states can do to spur new kinds of IT-enabled pedagogies, particularly in high schools and middle schools, is to emulate Minnesota's recent actions and create analogues to their NewSchools institution.

As the processes for educational innovation is opened up, new schools form. In Minneapolis, the rate of annual growth in enrollment in chartered schools has exceeded 30 percent over the past 10 years, and the enrollment in chartered schools in Minneapolis is projected to surpass enrollment in district schools possibly as soon as 2015.²⁶ The creation of new chartered schools is the first-half of the strategy for improving education.

What we need to turn our attention to now is the second-half of the strategy—namely, making sure that schools are innovating with the purpose of discovering new, more effective ways of applying technology and educating students well. America needs a large number of new schools to follow two principles: first, more teacher control (as opposed to administrator control), and second, pedagogy built around cutting-edge IT to support more personalized learning.

Minnesota's Strategy for Fostering Innovation in K-12 Education

In some school districts and some cities from coast to coast, something resembling a movement is under way and does just this. Alongside the continued growth of the chartered school sector, new and fundamentally different kinds of schools are being created within school districts. As a movement, the creation of fundamentally different kinds of schools within school districts is likely to be just as historically important as was the introduction of chartering in the early 1990s. For the first time we see evidence of boards, superintendents, and teachers—some with the active support of their unions—pushing for forms of schooling that are genuinely new and different.

The principal barrier to change has been the public education system: public education was not designed for change. Fortunately, as illustrated by Minnesota's experience, it is possible to solve this system problem. Landmark legislation recently enacted in Minnesota has opened the door for real zones of innovation within school districts by allowing schools to exercise unprecedented autonomy and to be different from other schools. The legislation has also created the first-of-its-kind state-level body whose purpose is to promote and protect innovative work in schools. With its intentional promotion of innovation in both the chartered and district sectors, Minnesota has become the first state to make K-12 innovation a state policy.

Minnesota is beginning the steps toward two state-level entities involved in overseeing public school. A model for this is shown in Figure 2. In this arrangement, not yet law, the State Department of Education is responsible for overseeing the traditional schools in both the districts and chartered schools. A state-level, but non-governmental, *NewSchoolsMinnesota* will oversee the nontraditional, substantially innovative schools which exist both in districts and as chartered schools.

NewSchoolsMinnesota is created to be a 501(c)3 nonprofit organization run by a board appointed by the governor and by Minnesota's legislative leadership. The schools it works with are new, independent (autonomous and

‘self-governed’ in the case of districts, per a new law passed in 2009), and innovative. They are approved and overseen by nonprofit sponsors. The tasks of *NewSchoolsMinnesota*, in both the charter and district sectors, include leveraging political, human, and financial resources; providing leadership and helping generate financial and other support for innovative schools; approving chartered school sponsors; and directing alternative assessment and research programs that better suit an R&D operation.

What separates the *NewSchoolsMinnesota* concept from other state-level commissions or working groups is its real power: to facilitate public grants and raise private resources, to set binding policy, and to execute directives. The entity will be a hybrid creature of the legislative and executive branches, assuming from the Minnesota Department of Education tasks of R&D that are better suited for an independent body. The purpose of *New-SchoolsMinnesota* is to see that the process of innovation happens. The organization would not implement innovations; that is the task of teachers and education entrepreneurs on the front lines. *NewSchoolsMinnesota* may house funds to aid replication of effective models, but replication is not its main task; fostering entrepreneurial innovation in the application of pedagogy to middle and high schools is.

“Fewer mandates, more authority for teachers, greater local-control...there is peace in the valley,” it was declared by a conservative Republican about the politics around Minnesota’s own proposal. An influential Democrat followed, “The reason why this is sailing through so quietly...is because of its common support” from unions, school districts, and business.²⁷

What State Governments Can Do to Foster K-12 Educational Innovation

Perhaps the single most important thing states can do to spur new kinds of IT-enabled pedagogies, particularly in high schools and middle schools, is to emulate Minnesota’s recent actions and create analogues to their *NewSchools* institution.

Minnesota’s thinking toward separation of the traditional and innovative sectors represents an important progression in the design of the education system. Innovative sectors require autonomy from the traditionally minded operations of a system. The traditional

side of public education was designed for incremental improvement at best. But today radical, fundamental changes are required to meet a changing landscape. When the world changes, a society or an organization needs to change the way it looks at the world, responds to it, prepares for it. It should disturb us that America’s schools today look little different than they did 60 years ago. *New-Schools* institutions can play a key enabling role in driving needed change.

What the Federal Government Can Do to Foster K-12 Educational Innovation

Congress and the Obama Administration have the capacity to influence state education policy. By stating its vision for school redesign, emphasizing that incremental innovation is no longer sufficient to produce the schools our country needs, Congress and the Obama Administration will find that at least some states are ready to follow.

State *NewSchools* operations will play an essential, instrumental role in seeing that explorative, entrepreneurial innovation occurs effectively in the public schools. They will be best positioned to leverage resources to see that information technologies are incorporated into the learning process. Therefore **one of the most effective ways for Congress to support innovation is to designate in the upcoming education reauthorization act funding specifically to encourage state legislatures to create these specialized organizations that are autonomous from the management of traditional schools.**

This federal source of funding might be called *NewSchoolsAmerica*, and like the state-level organizations it would act alongside—but separate from—the U.S. Department of Education and report directly to the Secretary of Education. It would provide capital grants for forming state innovation authorities, and for designing and forming new schools, and would help pay the initial capital costs for new technologies in schools.

The President and Congress can also help ease the process for innovation as the No Child Left Behind Act is reauthorized. That legislation is part of the traditional conception of schooling, where standardization and assessment are viewed as the primary levers of incremental improvement. But the innovation sectors of public education—chartering, in-district inno-

vation zones—do not fit into this paradigm. In order to run a program of innovation, exemptions must be made to state and federal course and content requirements. Alternative modes of assessment, as funded by foundations or state innovation authorities, must have room to gain legitimacy.

Roles for Nongovernmental and Nonprofit Groups in Fostering K-12 Educational Innovation

Although government can enable K-12 educational innovations, so too can and should the nongovernmental and not-for-profit sectors. **Foundations, in particular, can be powerful engines of change if they shift from subsidizing obsolete programs and instead contribute directly to *NewSchools* organizations or leverage their funds with the cooperation of the state *NewSchools* innovation operations.**

Business leaders can also play a key role. The success of a new-schools program will depend in significant part on whether outside groups leverage their influence to ensure things are indeed done differently. By and large, business leaders have not pressed for IT-enabled education redesign. In part, they resist telling districts what to do because they are not “the experts.” But many business leaders are experts on IT-enabled reengineering. **Business leaders need to step up to the plate, as Microsoft officials have done in Philadelphia, and help schools reengineer schooling around technology.**

V. CONCLUSION

The proper application of IT can significantly raise personalization of schooling with little or no marginal increase in labor costs. Personalization will improve

motivation on the part of students that can study at their own pace and direction, as it will improve the job of teaching.

Personalization requires placing students at the controls of learning, focusing as Art Levine says on what students learn, rather than what they are taught.²⁸ Such a realignment will not happen efficiently in our traditional course-and-class model of school. With the help of teachers themselves, new models of school can be designed around 21st century technologies and the students that so effectively use them.

To design schools for the 21st century, our country needs a strategy for educational innovation. At present, there is none. Chartering has gotten us part of the way there, but though many new chartered schools have been created, most of them do not depart from the pedagogy or management paradigm of batch-procession schools.

Serious innovation requires a protected space. States should set up, with assistance from the federal government, *NewSchools* organizations responsible for new school creation, with a particular focus on high schools and middle schools. Districts should be allowed to start new schools with autonomies on par with schools in states with the strongest of chartering laws.

The opportunities are significant. In school districts and cities from coast to coast something resembling a movement is under way. Alongside the continued growth of the chartered school sector, new and fundamentally different kinds of schools are being created within school districts. With the right help from Washington, this movement might soon become a breakthrough.

ENDNOTES

1. See forthcoming book by Tim McDonald, *Unsustainable*, from Rowman & Littlefield Education.
2. Center for Research on Education Outcomes, *Multiple Choice: Charter School Performance in 16 States* (California: CREDO, Stanford University, 2009).
3. Gail Russell Chaddock, “US High School Dropout Rate: High, But How High?” *The Christian Science Monitor*, June 21, 2006 <www.csmonitor.com/2006/0621/p03s02-ussc.html> (accessed July 13, 2009).
4. Clayton M. Christensen, Curtis W. Johnson, and Michael B. Horn, *Disrupting Class: How Disruptive Innovation Will Change the Way the World Learns* (New York, New York: McGraw Hill, 2008).
5. Steven R. Lerman, “Some Criteria for the Evaluation of Multimedia Computer Applications,” in *School Improvement through Media in Education*, Bertelsmann Foundation Publishers, Butersloh, 1995: 67.
6. ACT, “2006 ACT National Score Report News Release,” (ACT, August 16, 2006) <www.act.org/news/releases/2006/ndr.html> (accessed July 13, 2009).
7. Organisation for Economic Co-operation and Development (OECD), *Learning for Tomorrow's World – First Results from PISA 2003* (Paris, France: OECD, 2004) <www.oecd.org/document/55/0,3343,en_32252351_32236173_33917303_1_1_1_1,00.html> (accessed July 13, 2009).
8. A Report of the Commission Appointed by Secretary of Education Margaret Spellings, “A Test of Leadership: Charting the Future of U.S. Higher Education,” U.S. Department of Education, 2006 <www.ed.gov/about/bdscomm/list/hiedfuture/reports/final-report.pdf> (accessed July 13, 2009).
9. Justin D. Baer, Andrea L. Cook, and Stéphane Baldi, “The Literacy of America’s College Students,” American Institutes for Research, January 2006 <www.air.org/news/documents/The%20Literacy%20of%20Americas%20College%20Students_final%20report.pdf>.
10. Dan Lips, Shanea Watkins and John Fleming, “Does Spending More on Education Improve Academic Achievement?” *Backgrounder* 2179, The Heritage Foundation, Washington, D.C., September 8, 2008 <www.heritage.org/research/Education/bg2179.cfm> (accessed July 13, 2009).
11. To be sure, there are schools where efforts to create a longer school day, especially for kids who need extra help, can be very helpful. For example, Mass 2020 has helped foster the Expanded Learning Time (ELT) Initiative, which is redesigning schools to offer children new learning and enrichment opportunities made possible because of an expanded school schedule. See Mass2020, “ELT Initiative,” 2009 <www.mass2020.org/node/3> (accessed July 13, 2009).
12. National Commission on Excellence in Education, “A Nation at Risk: The Imperative for Educational Reform, 1983” A Report to the Nation and the Secretary of Education, U.S. Department of Education, April 1983 <www.ed.gov/pubs/NatAtRisk/index.html> (accessed July 13, 2009).
13. Guodong Gao and Lorin M. Hitt, “Information Technology and Product Variety: Evidence From Panel Data,” Twenty-Fifth International Conference on Information Systems, Washington, D.C., December 12-15, 2004 <opim.wharton.upenn.edu/~lhitt/files/itvariety.pdf> (accessed July 13, 2009).
14. Davis and Pine (1999).
15. Ted Kolderie, “Sparking Greater Innovation in K-12 Education,” transcript of Webinar on *Education Week*, March 26, 2008 <www.edweek.org/chat/transcript_03_26_08.html?r=444430151> (accessed July 13, 2009).

16. Robert D. Atkinson and Daniel D. Castro, *Digital Quality of Life: Understanding the Personal and Social Benefits of the Information Technology Revolution*, Information Technology and Innovation Foundation, Washington, D.C., October 2008 (15-17) <www.itif.org/files/DQOL.pdf> (accessed July 13, 2009).
17. In a meta-analysis review of 20 studies of middle-school students, Pearson et al. (P. David Pearson et al., “The Effects of Technology on Reading Performance in the Middle-School Grades: A Meta-Analysis with Recommendations for Policy,” Learning Point Associates, Naperville, Illinois, November 2005 <www.ncrel.org/tech/reading/pearson.pdf> (accessed July 14, 2009)) found that technology has a positive effect on reading comprehension. Waxman et al. (Hersh C. Waxman, Meng-Fen Lin, and Georgette M. Michko, “A Meta-Analysis of the Effectiveness of Teaching and Learning with Technology on Student Outcomes,” Learning Point Associates, Naperville, Illinois, December 2003 <www.ncrel.org/tech/effects2/waxman.pdf> (Accessed July 14, 2009)) concluded in a meta-analysis of studies that technology had a small but significant positive effect on student learning. Kulik (James A. Kulik, “Effects of Using Instructional Technology in Elementary and Secondary Schools: What Controlled Evaluation Studies Say,” report prepared for SRI International, Arlington, Virginia, May 2003) examined a range of studies that evaluated technology programs for reading, writing, math, and science. Kulik found that several programs for math, science, writing, and particular kinds of reading software improve student outcomes. In addition, various studies in Organization for Economic Cooperation and Development nations have found that Internet access can help make educational online activities more attractive and lead to improved educational performance. Likewise, several studies show, for example, that student writing improves in such situations, likely because students engage in more written communication and use of word processing.
18. Cleborne Maddux and D. LaMont Johnson, “Type II Applications of Information Technology in Education: The Next Revolution,” *Computers in the Schools* 23(1/2) (2006).
19. George E. Hein, “Contrivist Learning Theory,” CECA (International Committee of Museum Educators) Conference, Jerusalem, Israel, October 15-22, 1991 <www.exploratorium.edu/IFI/resources/constructivistlearning.html> (accessed July 13, 2009).
20. Tim R. McDonald, “Rethinking the Student-Centered Classroom,” *Engage Learner*, August 12, 2008 <www.engagelearner.org/index.php?option=com_content&view=article&id=48:rethinking-the-student-centered-classroom&catid=36:k-12-policy&Itemid=60> (accessed July 13, 2009).
21. The Institute for Defense Analysis, stemming from the trailblazing work the Department of Defense has been engaged in since the 1980s, calls it technology-mediated learning. Fletcher, J.D., “Technology, the Columbus Effect, and the Third Revolution in Learning,” Institute for Defense Analyses, Alexandria, VA, April 2001 <www.eric.ed.gov:80/ERICWebPortal/custom/portlets/recordDetails/detailmini.jsp?_nfpb=true&_ERICExtSearch_SearchValue_0=ED474406&ERICExtSearch_SearchType_0=no&accno=ED474406> (accessed July 13, 2009).
22. Edutopia, “Core Concept: Project Learning,” 2009 <www.edutopia.org/project-learning> (accessed July 13, 2009).
23. Stephen Ezell, Robert D. Atkinson, Daniel Castro and George Ou, “The Need for Speed: The Importance of Next-Generation Broadband Networks,” Information Technology and Innovation Foundation, Washington, D.C., March 2009 <www.itif.org/files/2009-needforspeed.pdf> (accessed July 13, 2009).
24. Minnesota New Country School (MNCS), Minnesota New Country School Website <www.newcountryschool.com/> (accessed July 13, 2009).
25. Microsoft, Microsoft Education Website <www.microsoft.com/education/schooloffuture.msp> (accessed July 13, 2009).
26. “Enrollment Trends in Minneapolis,” prepared for Education | Evolving colleagues, April 13, 2009 <thewrittenleague.googlepages.com/MPLSEnrollmentTrendsV3.pdf> (accessed July 13, 2009).
27. Minnesota E-12 omnibus committee, May 5, 2009.
28. Arthur E. Levine, “Waiting for the Transformation,” *Education Week*, February 25, 2009 <www.edweek.org/login.html?source=http://www.edweek.org/ew/articles/2009/02/25/22levine_ep.h28.html&destination=http://www.edweek.org/ew/articles/2009/02/25/22levine_ep.h28.html&levelId=2100> (accessed July 13, 2009).

ABOUT THE AUTHORS

Ted Kolderie is founding partner of the Minnesota-based group, Education|Evolving and a principal architect of chartered-school laws in Minnesota and many other states. He is a former journalist and has served as executive director of the Twin Cities Citizens League and as a senior fellow at the Humphrey Institute of Public Affairs.

Tim McDonald is an associate with Education|Evolving and the author of a forthcoming Rowman & Littlefield book about how technology will remake school design, performance, and finance.

ACKNOWLEDGEMENTS

The authors thank the following reviewers for helpful comments on the report: Steve Arnold, Polaris Venture Partners; Chris Gabrieli, Mass2020; Alan Schusterman, Founder and Head of School for Tomorrow; and Jerald Thomas, Aurora University.

ABOUT THE INFORMATION TECHNOLOGY AND INNOVATION FOUNDATION

The Information Technology and Innovation Foundation (ITIF) is a nonprofit, non-partisan public policy think tank committed to articulating and advancing a pro-productivity, pro-innovation and pro-technology public policy agenda internationally, in Washington and in the states. Through its research, policy proposals, and commentary, ITIF is working to advance and support public policies that boost innovation, e-transformation and productivity.

For more information contact ITIF at 202-449-1351 or at mail@itif.org, or go online to www.itif.org.
ITIF | 1101 K St. N.W. | Suite 610 | Washington, DC 20005