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ABSTRACT

This publication summarizes the lessons learned during 2002 in a collaborative project that had two central goals: (1) to assess the current thinking on sustainability and outlays for educational technology (edtech) investments by using as national case studies the cities of Chicago, Cleveland and Milwaukee; and (2) to highlight critical issues and models related to sustaining good educational technology practice. Sustainability is defined as strategies for maintaining and nourishing effective programs over time. Contents include: "Introduction: The Challenge of Taking Edtech to the Next Level" (Norris Dickard, Margaret Honey, Anthony Wilhelm); "Edtech 2002: Budget Challenges, Policy Shifts and Digital Opportunities" (Norris Dickard); "Back to the Future: Total Cost of Ownership and Other Edtech Sustainability Models" (Sara Fitzgerald); "Toward a Sustainability Framework: Lessons from the Literature and the Field" (Julie Thompson Keane, Andrew Gersick, Constance Kim, Margaret Honey); "Getting the Center To Hold: A Funder's Perspective" (Ronald Thorpe); and "Edtech in Indian Country" (Kade Twist). Appendixes include: "No Child Left Behind Act, Edtech Provisions" and a table, "What Is Your School District's Total Cost of Ownership Type?" (AEF)

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THE SUSTAINABILITY CHALLENGE
TAKING EDTECH TO THE NEXT LEVEL

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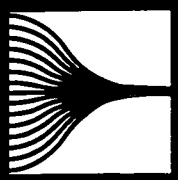

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TAKING EDTECH TO THE NEXT LEVEL

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Education Development Center, Inc.
Center for Children and Technology

Edited by Norris Dickard

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THE SUSTAINABILITY CHALLENGE: TAKING EDTECH TO THE NEXT LEVEL

In the last decade, the federal, state, and local governments have invested over $40 billion to put computers in schools and connect classrooms to the Internet.

Results are positive related to hardware and connectivity. The percentage of schools connected to the Internet rose from 35 percent in 1994 to 99 percent in 2001. The student to Internet connected computer ratio has improved dramatically in an even shorter time frame, going from 12 students per computer in 1998 to five to one in 2001. Many students who do not have computer and Internet access at home at least have some access at school. However, there are indications that many schools are not using this new infrastructure to maximum advantage.

The National Governors Association and the National Association of State Budget Officers released a report in November 2002 saying states face the most dire fiscal emergency since World War II, concluding many have exhausted budget cuts and rainy-day funds and that the most difficult cuts lie ahead. Already some states are cutting educational technology (edtech) funds. Technology fatigue may also be hitting state and local policymakers just as they are given new authority (under the No Child Left Behind Act) to transfer federal edtech funds to other uses.

A number of critical actions are needed to sustain our school technology infrastructure and to take it to the next level. The "top 10" list includes:

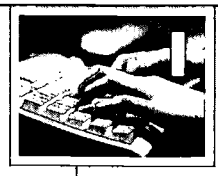
1. Accelerate teacher professional development
2. "Professionalize" technical support
3. Implement authentic edtech assessments
4. Create a national digital trust for content development
5. Ensure all Americans have 21st century skills
6. Make it a national priority to bridge the home and community digital divides
7. Focus on the emerging broadband divide
8. Increase funding for the federal edtech block grant
9. Share what works
10. Continue edtech funding research

There are a number of emerging models that states and local districts can follow to get the most from, and sustain, their instructional technology infrastructure. The Consortium for School Networking's "Total Cost of Ownership" model is one. Based on case studies in districts that are on the cutting edge of using instructional

technology, this report also introduces a framework, or critical factors, for successful technology integration that are the building blocks of sustainable educational technology programs. Among the critical factors: leadership, effective management, infrastructure, professional development, and a broad coalition of stakeholders.

The findings in *The Sustainability Challenge* were based on research, fieldwork in three Midwestern cities, and a series of grantmaker roundtables held in New York, Chicago and Washington, D.C. The project was supported with a generous grant from the Joyce Foundation of Chicago and is the third in a series focusing on the E-Rate and other edtech investments.

CHAPTER 1
INTRODUCTION: THE CHALLENGE OF TAKING EDTECH TO THE NEXT LEVEL



BY NORRIS DICKARD, MARGARET HONEY AND ANTHONY WILHELM

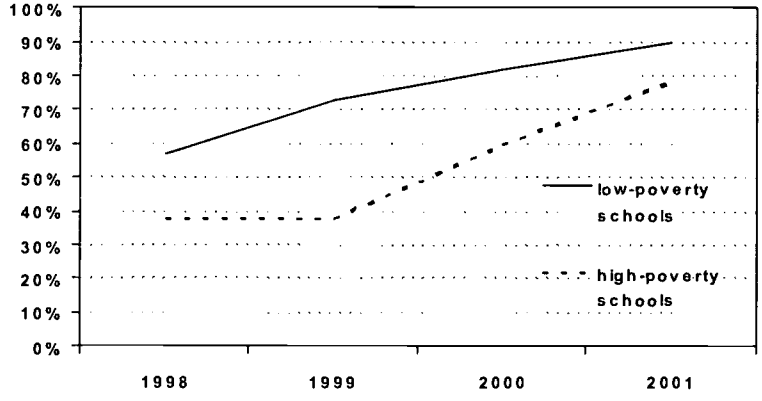
Since 1990, the nation has invested over $40 billion to bring computers, educational software, and Internet connections to America's schools. Whether success is measured by the percentage of classrooms with a multimedia computer, test score improvements or the digital literacy of tomorrow's workforce, administrators, policymakers and parents hope this unprecedented investment in information technology (IT) will vastly improve the productivity of the educational enterprise.

A September 2002 report of the National Center for Education Statistics highlighted the rapid pace of change in schools as a result of this massive infusion of capital. The percentage of schools connected to the Internet increased from 35 percent in 1994 to 99 percent in 2001. The student to Internet connected computer ratio has improved dramatically in an even shorter time frame, going from 12 students per computer in 1998 to 5 to 1 in 2001. Likewise, there has been a significant rise in teachers using computers and networks for planning and instruction.

A Nation Online, released in early 2002 by the U.S. Department of Commerce, showed that American children who lack access to computers and the Internet at home are relying on wired schools and libraries for access. For example, thanks to these public access facilities, nearly 90 percent of all school-aged children (aged 5-17) use computers and 59 percent used the Internet — making American children the most connected in the world. Just over 80 percent of children (aged 10-17) in the lowest income category were using computers at school, little different from the 89 percent of children from households in the highest income category.

Hispanic and Black children, who have much lower computer use rates at home, approach the overall computer use rates of Whites and Asian American/Pacific Islander children largely because of public access: 84 percent for Hispanic children, 89 percent for Black children, 94 percent for Asian/Pacific Islander children, and 95 percent for White children. However, a far higher percentage of Hispanic (39 percent)

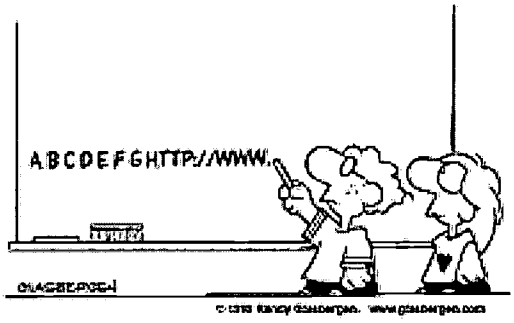
... K-12 Instructional Rooms with Internet Access



Source: NCES, *Internet Access in U.S. Public Schools and Classrooms: 1994-2001*, Sept. 2002

and Black (45 percent) children rely solely on public access facilities to use computers than White children (15 percent).

Despite this good news, students say more needs to be done to ensure we get a full return on the nation's IT investment in schools. According to a 2002 Pew Internet & American Life study, *The Digital Disconnect: The widening gap between Internet-savvy students and their schools*, students said it was imperative to connect classrooms and not just schools, ensure that all students master computer literacy skills, and train teachers to create assignments that take advantage of Internet resources they found on their own.



Similarly, technology coordinators indicated in a National School Boards Foundation survey that schools are not taking full advantage of technology as a tool to improve teaching and learning. The report "Are we there yet?" concluded: "It is not enough to install computers and wire classrooms for Internet access, although there is still plenty of work to do in this regard. Today, the focus needs to expand to how schools are using technology."

A focus on effective classroom use is hampered by the current economic climate and the changing role of the federal government related to educational technology. These changes have resulted in school IT investments coming under greater scrutiny than ever — with a heightened focus on measurable results. The years 2001 and 2002 saw the stock market tumble and with it state, local and federal budget revenue. Fierce budget battles in state capitols resulted in edtech in some cases moved to the expendable column, joining the ranks of art and music programs that are seen as a luxury for flush times.

As is explained in Chapter 2, it is possible that state and local administrators may use the new transfer authority of the No Child Left Behind Act (NCLB) and begin to pull back from fully implementing and funding edtech programs, believing them to be ineffective or arguing that the funding would be better spent elsewhere.

We come to these conclusions from years of joint Benton Foundation and Center for Children and Technology work in the edtech field and policy arena. Most recently, in January 2002, we published in *Great Expectations: Leveraging America's Investment in Education Technology*, an outline of the findings from an 18-month, Joyce Foundation funded project. We provided a snapshot of the state of educational technology and outlined needed steps to ensure that our national edtech investments were maximized. These included recommendations for improvements to the E-Rate (i.e. the education rate, or the Federal Communications Commission's $2.25 billion a year in telecommunication's discounts to schools and libraries), new strategies and models for assessing students' technology-based work, and a state and local framework for assessing and improving edtech implementation.

Even as we completed the "Great Expectations" project in fall 2001 we began to suspect that "technology fatigue" was beginning to hit some policymakers at precisely the time when we needed more and smarter investments in edtech, not less. We began a follow-up project to investigate.

This current publication summarizes the lessons learned during 2002 in a subsequent Joyce Foundation funded effort. The Benton Foundation and the Center for Children and Technology collaborative project had two central goals: (1) to assess the current thinking on sustainability and outlays for edtech investments by using as national case studies the cities of Chicago, Cleveland and Milwaukee and (2) to highlight critical issues and models related to sustaining good educational technology practice. We defined sustainability as strategies for maintaining and nourishing effective programs over time.

In Chapter 2, Norris Dickard discusses the current fiscal crisis in states, the impact on edtech and the potential effect of NCLB on edtech expenditures. He then examines several federal and state policies, proposed and enacted, that are meant to ensure home technology access for all students and serve as the catalyst for a golden age of digital content creation. In Chapter 3, Sara Fitzgerald raises the emerging issue of technical support and refreshment cycles, highlights several state approaches to benchmarking in this area, and introduces the Consortium for School Networking's Total Cost of Ownership model.

In Chapter 4, the team from the Center for Children and Technology provides an overview of their sustainability framework, using as a context their field work in various U.S. cities and review of the relevant literature. In Chapter 4, Ron Thorpe writes from the perspective of a non-governmental grantmaker about sustaining programs, offering important insights that will be helpful to the field. Kade Twist, in Chapter 6, highlights the particular challenges that face schools in Indian Country as they seek to ensure digital opportunities for all their students.

From work on our project we contend that it is imperative for schools to leverage the large edtech investments they have made to date, to maintain the infrastructure they have in place and be strategic about upgrading and supporting networks in the future. If local schools do not develop the talents of staff, if they do not rethink how edtech can be more effective in fulfilling their core missions and, if they do not provide technical support and incentives for trained professionals to stay, then this first wave of edtech investments will have been badly made.

Even as the nation focuses on improvements in how schools use and maintain their instructional technology infrastructure, a pressing and related issue is home access for all students. The students interviewed in the Pew studies expressed a serious concern about the digital divide, or the lack of home access to computers and the Internet of their less fortunate peers. As in other surveys, the tech-savvy students who were surveyed indicated that most of their computer work and learning took place at home. These students realized their less fortunate and connected peers were at a distinct disadvantage.

While recent data demonstrate that access to computers and the Internet are clearly increasing for all demographic groups and, as previously noted, disadvantaged children are benefiting from their access at schools, a closer examination of the census data used for *A Nation Online* reveals worrying home disparities — disparities teachers witness everyday. Almost half of Americans still do not have Internet access at home. Only 25 percent of America's poorest households are online, compared with approximately 80 percent of homes earning over $75,000.

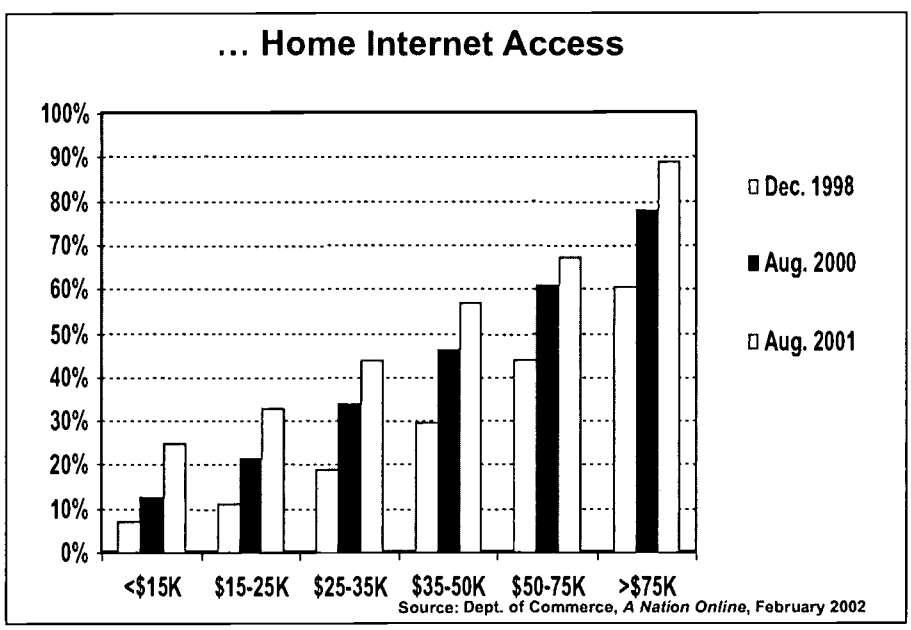
Only 33 percent of children living in households in the lowest income category use computers at home compared to 95 percent of youth in the highest income category, according to a joint Annie E. Casey Foundation/Benton Foundation report, "Connecting Kids to Technology: Challenges and Opportunities." Even more troubling is the fact that the gap between these groups has expanded in recent years. Similar disparities can be found among student populations: Hispanics (32 percent) and African Americans (40 percent) lag behind Whites (60 percent) in Internet access at home, suggesting serious ethnic and racial divides. We assert that, in the 21st century, sending some students to homes without a computing device — whether it be a computer, handheld device, or the like — and an Internet connection would be like, in the 20th century, sending some students home, depending on their household income or the educational level of their parents, without their textbooks — and then expecting them to do as well in the classroom.

The publication *2020 Visions: Transforming Education and Training Through Advanced Technologies,* released in September 2002 by U.S. Secretary of Commerce Evans and Secretary of Education Paige, highlights what an exciting future we might expect with new innovations in instructional technology looming on the horizon. The golden age of digital learning may be around the corner if we do not short-circuit the process now.

Based on our recent and past work in this arena, we declare these 10 critical next steps must be taken if we are truly to meet the sustainability challenge and take educational technology to the next level:

1. **Accelerate teacher professional development**

   The No Child Left Behind Act mandates that states and local communities spend a set percentage of their funding on teacher professional development. If done correctly, this added focus on professional development can help us



accelerate the training of teachers and improve their ability to use powerful new technologies. We also must finish the job already begun of revamping our colleges of education, so that new teachers replacing the large cohort of retiring educators enter our schools with cutting-edge skills.

2. **"Professionalize" technical support**

   One of the most neglected areas in school technology has been the support given to teachers, network administration and system design. Many large school districts have, like industry, created and filled the position of Chief Information Officer. Smaller districts have outsourced their work in this area. Others have relied on already burdened teachers or students. Technical support should be given the professional status it deserves.

3. **Implement authentic edtech assessments**

   In an era in which results are paramount, policymakers at the state and local level must be careful not to pull the plug on their edtech investments because they see little short-term gain in student test scores. Assessments must be tied to the specific goals for which technology is used, such as reading improvement or technology literacy, and treated as an important, but not the sole, variable in the learning equation.

4. **Create a national digital trust for content development**

   To truly transform education and training through advanced and emerging technologies we believe that the federal government must serve as a significant catalyst for digital content creation. Private industry cannot go it alone. One of the most promising proposals to achieve this goal is the call for the creation of a Digital Opportunity Investment Trust (DO IT), discussed in the next chapter. With the E-Rate covering telecommunication and networking equipment discounts and the NCLB technology block grant covering computer upgrades, software purchases and teacher training, DO IT would provide the missing link in federal investment.

5. **Ensure all Americans have 21st Century Skills**

   NCLB states that one goal of the federal investment in the edtech arena is "to assist every student in crossing the digital divide by ensuring that every student is technologically literate by the time the student finishes the eighth grade, regardless of the student's race, ethnicity, gender, family income, geographic location, or disability." The U.S. Department of Education is investigating what this means and is taking an expansive view of the term literacy. An important component of leaving no child behind in the digital age is ensuring their parents are fully engaged in their education. To accomplish this, we must ensure no parents are left behind in the dark age of illiteracy and that they have ample opportunity to develop 21st Century Skills.

6. **Make it a national priority to bridge the home and community digital divides**

   Technology can play a key role in ensuring all Americans, K-12 students and adults, have 21st Century Skills. Two years ago, *e-Learning: Putting a World-Class Education at the Fingertips of All Children, The National Educational Technology Plan* called for ensuring equal information technolo-

gy access not just in schools, but in homes and communities as well. A few states and local school districts have taken up the charge, and other policy proposals have been presented to achieve this goal. As a start, we must set a national goal of ensuring every child on the reduced and free lunch program has home access to a computing device and the Internet.

7. **Focus on the emerging broadband divide**

   The digital learning content of the future will require greater bandwidth. A new broadband divide is emerging with the potential that some Americans will be relegated to second-class, information age citizenship. Federal policymakers must focus on policies to ensure all Americans, especially those in rural and inner city areas, have access to widely available and affordable broadband connections.

8. **Increase funding for the federal edtech block grant**

   To meet the sustainability challenges outlined above states and school districts will need additional resources. Therefore, we advocate an increase in the NCLB edtech block grant to $1 billion, beginning in fiscal year 2004. In fiscal year 2001, U.S. Department of Education funding for the eight edtech programs authorized under Title III of the Elementary and Secondary Education Act rose to an all-time high of $872 million. This was a 5,700 percent increase from the $23 million appropriated in 1993. President Bush's FY 2003 budget request for these programs, consolidated in a block grant in the No Child Left Behind Act (NCLB), was $723 million — a sharp decrease in dedicated funds for this purpose.

9. **Share what works**

   In this age of accountability, states and local government will be looking for guidance on effective educational technology solutions. Through the U.S. Department of Education's new What Works Clearinghouse, research efforts, and other governmental and corporate demonstrations, a concerted effort must be made to assist them. As *e-Learning* advocated, "we should: initiate a systematic agenda of research and evaluation on technology applications for teaching and learning; encourage state and local evaluations of technology programs; and support the dissemination and use of research-based information..." NCLB contains such provisions.

10. **Continue edtech funding research**

    From our work on this project, we believe it remains an open question how and whether schools will nourish their edtech efforts in coming years. While the federal government's share of overall education spending is relatively small, about 7 percent, its share of edtech funding is substantial, encompassing about 35 percent of all funding. This 35 percent is magnified when one considers that most federal edtech investments and the E-Rate are directed at high-poverty schools. Since the federal government launched schools on the e-learning path, it is imperative to track funding at the state and district level to see how the edtech sustainability challenge is being, or not being, met.

CHAPTER 2
EDTECH 2002: BUDGET CHALLENGES, POLICY SHIFTS AND DIGITAL OPPORTUNITIES

BY NORRIS DICKARD

In late 2002, leaders involved in implementing technology solutions to improve teaching and learning were faced with a bleak budget picture and changing policy climate. Educational technology (edtech) expenditures that were part of budget lines came under greater scrutiny than ever — with results expected sooner rather than later. At the same time, state and local innovations and new federal policy proposals reflected exciting opportunities to ensure that no children in the U.S. would be left behind in the information age.

BUDGET WOES

Many states that benefited from the economic boom of the late-1990s suffered sharp revenue declines in the recent recession. In Virginia, where the suburbs of the nation's capital helped spawn the dot-com industry and witnessed the subsequent bust, state revenue growth plunged to its lowest level in 40 years. In fall 2002, announcing even tougher austerity measures to come, Virginia Senate Finance Committee Chairman John Chichester commented, "Quite frankly, I want every citizen of Virginia to understand that our back is against a financial wall. It's not their fault, it's not our fault – but we're all in it together." He could have been speaking for the nation.

State budgets were expected to remain depressed through fiscal 2003, according to *The Fiscal Survey of States*, a report released by the National Governors Association and National Association of State Budget Officers in spring 2002. According to the report, the economic downturn caused a $40 to $50 billion budget shortfall in over 40 states. Despite the fact that some states exempt education from budget cuts, 39 states were forced to reduce their enacted budgets by $15 billion. To plug their budget gaps, 26 states used across-the-board cuts, 22 tapped rainy day funds and 10 reorganized programs. At least 11 states had to call special legislative sessions. In an article in *Education Week*, educational technology experts reported that technology programs appeared to be among the first targets of the budget knife. "Governors are dealing with unprecedented fiscal pressure," announced NGA Executive Director Raymond C. Scheppach.

These trends were verified in one of the states where the Benton Foundation and the Center for Children and Technology (CCT) conducted casework: Illinois. Edtech funding was slashed in the state FY 2003 budget — receiving one of the greatest hits in terms of budget line items within the Illinois State Board of Education (ISBE) budget. School districts felt the biggest pinch in 2002 with direct state edtech grants to districts reduced by over $15 million to less than half of previous levels of $28 million. The budget for online resources for school districts was also reduced by over one-third. By most accounts, projections for the Illinois FY 2004 budget look bleak as well.

"Illinois policymakers are playing guessing games with serious consequences," said Bindu Batchu, author of a report on technology in Illinois classrooms released by the Metropolitan Planning Council and Network 21, a coalition for school reform. "These cuts will make implementing any vision set forth in the state's forthcoming education technology plan very difficult as much of the federal edtech money for Illinois classrooms hinges on matching state funds." Network 21, in a unique state lobbying effort, mobilized and voiced opposition to the cuts through careful policy analysis, highlighting disparities in Illinois state per pupil spending and outlined a vision for why edtech matters.

State and local innovation, as well as the budget crisis many states face, will all be affected by a redefined relationship to the federal government, which has been a significant catalyst for helping bring schools into the digital age.

FEDERAL POLICY CHANGES: NO CHILD LEFT BEHIND ACT

The new Enhancing Education Through Technology Program was passed as part of the No Child Left Behind Act of 2001 (NCLB), a reauthorization of the Elementary and Secondary Education Act. It contains new provisions in how federal edtech funding gets spent. One stated new goal of the legislation is to assist every student in America in crossing the digital divide and becoming fully technology literate by the eighth grade.

In proposing NCLB, the Bush administration's goal for edtech was to consolidate all of the separate grant programs created under the Clinton administration (with priorities such as community technology center creation, promotion of innovative projects, and support for distant education learning programs) into a new state block grant program. All of the savings from the program cuts were to be rolled into a revamped Technology Literacy Challenge Fund, the existing state block grant, and delivered by formula to the districts.

As was discussed in the Benton Foundation and CCT's previous report *Great Expectations: Leveraging America's Investment in Educational Technology,* the original plan even called for eliminating the $2.25 billion-per-year E-Rate — telecommunications discounts to schools from the Universal Service Fund, under the direction of the Federal Communications Commission — and requesting appropriations for the $2.25 billion under a new edtech "super" block grant.

In attempting to sell the proposal in 2001, the administration touted its advantages to school districts: more money, less hassle in applying and more discretion in using the funds. Critics decried a lack of "federal leadership" – in terms of a dedicated pool of funds for programs addressing national priorities, like community technology center development – and in the case of the E-Rate, the near certain loss of a substantial proportion of its support if congressional appropriations were required. In the end, the U.S. Senate pushed back, protected the E-Rate and reached a grand compromise on NCLB, which was passed in January 2002 and included the Enhancing Education Through Technology Program.

This program included an edtech block grant but, because of Senate pressure, maintained Ready to Learn Television as well as the Preparing Tomorrow's Teachers to Use Technology and Community Technology Centers programs (CTC). Under NCLB, states must distribute 95 percent of their edtech block grant funds to local school districts. Fifty percent must be distributed via formula and 50 percent via competitive grants – yet another compromise forged between Congress and the administration.

Five percent of the funding allocated to state agencies in the block grant may be used for "leadership activities" that allow them to provide districts with technical assistance, establish public-private technology acquisition initiatives to assist high-need districts, assist districts in providing professional development services, ensure special needs students gain access to technology, develop performance measure-

ments to determine the effectiveness of edtech in helping students meet high academic standards, and collaborate with other states to develop and make available distance learning curricula.

Additionally, districts must now use 25 percent of their funds for professional development in technology, with special attention given to the integration of advanced technologies into classroom curricula. The move comes as a result of calls in many studies including the Benton Foundation's 1997 *Learning Connection: Schools in the Information Age*, which warned that America's investment in edtech would be at risk if we neglected the training of teachers.

Two percent of NCLB funds will be reserved by the U.S. Department of Education to create a new national technology plan, provide technical assistance and conduct a longitudinal study on the effectiveness of using edtech to increase student academic achievement.

One of the most pronounced NCLB changes is in the ability state and local governments will have to transfer funds between certain funding blocks. Any district that has not been identified as in need of improvement now has the ability to transfer up to 50 percent of its formula allocation under the Teacher Quality State Grants, Educational Technology State Grants, Innovative Programs or Safe and Drug-Free Schools programs to supplement its allocation under any of the programs listed above. Thus, in states and districts where leaders feel edtech is not delivering a return on investment, half of those funds can be transferred elsewhere. Likewise, where edtech is seen as central to improvements in teaching and learning, "new" resources are available – at the expense of other programs, of course.

NCLB also requires states to test every student in grades three through eight annually in the "basics," i.e. reading and math. This is a significant shift from the multi-year cycle currently used. One result could be the accelerated use of information technology for assessment and data analysis that could provide information for needed changes at the classroom or school level. There are a number of innovative products and experiments already underway. This year, Idaho became the first state to switch to computerized "smart tests" that adapt to the test-taker and provide rapid feedback on needed areas of improvement. A study by the Rand Corporation concluded: "Computer-based testing offers the opportunity to develop new types of questions, especially those that can assess complex problem-solving skills by requiring examinees to generate their own answers."

Released in early 2002, President Bush's FY 2003 budget proposed funding the state edtech block grant at the same $700 million level as FY 2002 — a significant reduction in funding dedicated to educational technology in FY 2001 at the end of the Clinton administration. The overall requested one percent increase for the entire department was the smallest since FY 1995. Bush administration officials went on the defensive with a prominent series of graphs displayed on the Education Department website showing how past increases in funding had not resulted in student performance improvements.

Among those edtech programs the president deemed narrowly focused or ineffective and therefore slated for termination in FY 2003 are the Preparing Tomorrow's Teachers to Use Technology Program ($62.5 million in FY 2002), Community Technology Centers Program ($32.5 million in FY 2002) and the Star Schools Distance Education Program ($27.5 million in FY

2002). John Bailey, director of the Office of Educational Technology at the U.S. Department of Education, has defended the overall edtech and individual grant program cuts in various speeches, interviews and articles, arguing that most of the activities were allowable under the state block grant and NCLB had provisions sprinkled in other titles allowing for technology purchases to meet specific learning goals such as improving reading.

THE DIGITAL DIVIDE AND NATIONAL POLICY

The administration's call to eliminate in FY 2003 two critical digital opportunity programs generated a significant backlash. In May 2002, on the steps of the U.S. Capitol, Senators Max Cleland and Barbara Mikulski, with the support of Senator Olympia J. Snowe, joined representatives of over 100 organizations to launch the Digital Empowerment Campaign (www.digitalempowerment.org), a nationwide grassroots effort to preserve and strengthen the U.S. Department of Commerce's Technology Opportunities Program (TOP) and the U.S. Department of Education's Community Technology Centers Program.

The CTC program provides matching grants that leverage state, local and corporate resources to create and improve technology access and training facilities — a place where unplugged Americans can go to get plugged in. The TOP program provide matching grants for innovative projects that use technology to solve social problems, improve communities and increase access to advanced telecommunication's services.

The administration's proposed cuts were bolstered by a marked change in administration rhetoric. In February 2002, the U.S. Department of Commerce released *A Nation Online*, the latest in a series of studies previously known as *Falling Through the Net*, on computer and Internet use in America. The series was formerly a national benchmark for measuring the digital divide between those who have access to modern telecommunications tools and services and those who do not. The implied message of *A Nation Online* was that the digital divide was no longer a major concern — a position simply not supported by the report's own statistics. For example, almost half of American households do not have access to the Internet. Higher-income Americans are more than three times as likely to be online as those with lower incomes. Whites and Asians are six times more likely to use the Internet than Blacks or Hispanics. And 75 percent of lower-income Americans do not have Internet access.

To counter this report, the Benton Foundation and the Leadership Conference on Civil Rights Education Fund published *Bringing a Nation Online: The Importance of Federal Leadership*. Released in summer 2002, the report re-examines the government's own statistics and fully articulates why the digital divide is still a problem of national significance. The report also outlined why the two programs slated for elimination — the TOP and CTC — are important national tools in bridging the digital divide.

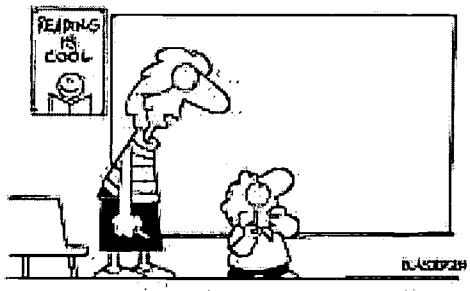
U.S. Department of Education officials responded that states and local districts have the option of spending their block grant funds, or transferring monies from other sources, if providing access to students in their communities or homes is a goal. In particular, they have pointed to the Maine model as an example of what is possible.

Governor Angus King of Maine gained headlines in 2002 with a proposal to ensure technology access for all students in his state. He spearheaded the controversial effort culminating in a four-year, $37 million contract with Apple Computer to provide — as a start — wireless iBook laptops to all middle school students and teachers in Maine.

A similar federal policy proposal — at least in its focus of ensuring home access for all students – involved tax credits. In the aftermath of September 11, U.S. Senators George Allen and Barbara Boxer requested that President Bush support their Education Opportunity Tax Credit as part of the economic stimulus plan. Their bill, S. 488, would give parents a refundable $1,000-per-child tax credit – capped at $2,000 per family — that could be used for education expenses such as computers, printers, peripherals and educational software.

The senators, representing states with a substantial information technology sector, stated the proposal would stimulate the economy and help bridge the digital divide. "This proposal increases access to computers and the Internet in the home for households of all incomes, and consumers reap the tangible, and intangible, benefits of buying a major durable good," they wrote.

Both models are worthy of consideration. Admittedly, tax credits have had a dubious history and when tailored poorly, they help only those who did not need the financial assistance in the first place. An article critical of tax credits by William Gale of the Brookings Institution was aptly titled "Social Policy in Bad Disguise." However, the feasibility of a targeted and refundable tax credit to those who research shows are most cut off from digital opportunities – such as the families of children receiving free and reduce price lunches – should be studied. Providing laptops to every student in a state is cost-prohibitive but, with new low-cost computing devices coming on the market, states should explore this and other strategies to ensure home access.



"There aren't any icons to click. It's a chalk board."

Local community technology centers, such as the Washington, D.C.'s Calvary Bilingual Multicultural Learning Center and their Digital Community Project, have also set up programs where parents and children receive computer literacy training and then can purchase a new computer through a specially insured loan program at a local bank (www.cbmlc.org). They receive one year's free Internet access and subsequent years at a reduced rate. Home technical support is provided by youth volunteers and special classes on various software programs are offered at the center.

POLICY INNOVATION: THE DIGITAL OPPORTUNITY INVESTMENT TRUST

Another set of innovative policy proposals involves the complex world of spectrum policy. During 2002, a group led by former NBC news chief Larry Grossman and former Federal Communications Commission chairman Newt Minow called for the creation of a Digital Opportunity Investment Trust (DO IT). Their Digital Promise Initiative (www.digitalpromise.org) calls for the creation of a trust that would be financed by revenue from the auction of publicly owned airwaves, with an estimated value of over $20 billion.

Grossman and Minow propose that DO IT provide grants to fund the development of new learning software and tools to make the best use of Internet connections to

America's schools. DO IT would also fund the digitizing of select material in America's museums, libraries and universities. In 2002, legislation was introduced in both the U.S. Senate and House of Representatives to establish the fund. Senators Christopher Dodd and Jim Jeffords co-sponsored the Digital Opportunity Investment Trust Act, which would provide 50 percent of the revenues from the spectrum auctions to support the DO IT fund. Rep. Edward Markey introduced a similar bill in the House.

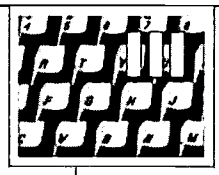
The DO IT legislation is modeled after a 19th century proposal passed during the Civil War. The Land-Grant Colleges Act of 1862 stipulated that money from the sale of public land be used to create land-grant colleges and universities so that everyone — not just the elite — could benefit from higher education. DO IT proponents argue that the 21st century equivalent of land is the airwaves — or more accurately, the electromagnetic spectrum — and they want to ensure the public interest is served from its use. U.S. Commerce Secretary Evans and Education Secretary Paige, intrigued by these ideas, commissioned papers on what education and training would look like in the future. The papers were compiled in a publication, *2020 Visions: Transforming Education and Training through Advanced Technologies.*

CONCLUSION

With private sector investments in technology programs waning because of the recession and with state budgets under the biggest crunch in years, the need for smart, public-private partnerships to accelerate digital opportunity is more important than ever. With the devolution of power to the state and local leaders, leadership and innovation at that level will drive change and provide new models. Federal policy proposals currently under consideration offer a glimpse of exciting opportunities, if implemented, to ensure that no American children will be left behind in the information age.

Norris Dickard is director of public policy at the Benton Foundation.

CHAPTER 3
BACK TO THE FUTURE: TOTAL COST OF OWNERSHIP AND OTHER EDTECH SUSTAINABILITY MODELS



BY SARA FITZERALD

Education policymakers are commenting that education technology has finally "arrived." As evidence, they point to the provisions of the No Child Left Behind Act (NCLB).

Although the Bush administration's signature education legislation retains a dedicated edtech block grant program, woven throughout the law are references to technology that would allow it to be used for broader academic goals. Technology, the law's proponents argue, is no longer viewed as an end unto itself, but, rather, is viewed as an important educational tool that, when used effectively, can promote student learning.

But has the average American school district made that leap? Do school leaders view technology as "the thing we did when we had money?" Or do they understand that, like the addition of a new school bus or a new classroom, every additional networked computer will require more dollars to be spent on support, maintenance, staff development and a number of other related costs if it is going to be used effectively?

School technology leaders may well have recognized that hardware costs were simply the first budgetary challenge their schools would face when it came to implementing technology solutions to approve teaching and learning. But many have failed to plan for an ongoing, consistent funding stream for technology support, relying instead on one-time infusions of money, whether in the form of E-Rate discounts on infrastructure purchases, successful bond campaigns, dedicated federal funding programs to put computers in classrooms, or special corporate and non-profit support, all of which were widely available during economic boom times.

All of the activities associated with the ongoing "care and feeding" of computers and networks are what the business world calls the "Total Cost of Ownership," or TCO. Now, more than ever before, school leaders are being challenged to provide networked resources in cost-efficient ways that are tied to their own needs and goals – and to monitor how well those approaches are working.

At its core, NCLB arguably looks at K-12 education from a business-like perspective. In the end, schools will be judged by the quality of their products and be held accountable. Customers, namely parents, will be encouraged to "shop elsewhere" if they aren't satisfied with the "service" their children are receiving.

Whether or not one agrees with this approach, it's clear the new law will present some tough decisions for school leaders on where to put their scarce dollars.

The business world began wrestling with how best to manage TCO in the mid-1980s, as companies started to move from a mainframe computer environment to distributed computing on the desktop of every employee. There was no avoiding the fact that computers would continue to require support and generate new costs. But by making the right decisions when they deployed a network, businesses learned they could save money in the long term, or that the strategic advantage they gained would more than justify the cost of their technology investments.

One challenge for school leaders who understand that technology must continue to be supported adequately is that there are relatively few metrics on what "sufficient" means — other than "more money." Projections of the costs of wiring the nation's schools that were made in the mid-1990s came at a time when many schools aspired simply to build a single computer lab, or "become connected to the Internet."

Since then, not only has classroom Internet connectivity become nearly ubiquitous, but schools are testing a wide range of new approaches including centralized network management, wireless networks, thin-client computing, student laptop programs and the use of other low-cost devices such as personal digital assistants.

In 1999, the Consortium for School Networking's (CoSN) "Taking TCO to the Classroom" initiative began with the goal of helping school leaders understand the range of costs for which they should budget when they implement technology, and some "best practices" that could be followed to try to control those costs.

Surveys conducted by education marketing companies have consistently found that schools devoted the lion's share of their technology budgets to hardware, whether it was infrastructure or desktop computers, and substantially less to categories, such as tech support and professional development, that should increase as computer penetration in the classroom grows. For example, Quality Education Data reported in its projection of edtech spending for the 2000-01 school year that schools anticipated spending 56 percent of their budgets on hardware and networks, but only 4 percent on staff development and 8 percent on "service/support." Market Data Research, in a 2001 review, reported that districts spent 67 percent on hardware, compared with 14 percent on staff development — still well short of the 30 percent figure that the U.S. Department of Education began advocating in the late 1990s.

Ongoing, adequate tech support is one of the biggest challenges for school districts. Supporters of the No Child Left Behind Act envision a future in which schools will be able to continually assess how their students are performing, make adjustments where necessary, and rapidly report their results, not only to state and federal policymakers, but also to parents. However, none of that data-driven decision-making will be possible if a network is not adequately supported and maintained — in short, made reliable.

"Thank you for calling our Technical Support Hotline. The longest we've ever kept anyone on hold was 19 hours and 23 minutes. If you break that record today, you will win $10,000! Good luck!"

Moreover, as policy makers at all levels stress the need for teachers to learn how to integrate technology into the classroom, one real impediment may be teacher time. Seventy-eight percent of teachers in a 2001 NetDay survey said their biggest obstacle to using the Internet in their classroom was "a lack of time." If a teacher makes the effort to adapt a lesson plan to the online environment, only to find that the network is "down" that day, why wouldn't she go back to relying on more traditional approaches?

In the past few years, more and more states have begun adopting technology inventory surveys, which can help districts monitor the progress they are making compared with their local peers. (Some states are now using these same surveys to determine which districts are technology "have-nots" for purposes of awarding competitive technology grants under the No Child Left Behind Act.)

A rule-of-thumb in the business world has been that one tech support person is necessary to support 50 to 75 computers. In

the K-12 environment, this ratio has been much higher, which is one reason tech support personnel often suffer from a high level of burnout. However, there is no single right answer because the level of tech support that is necessary depends on a number of interrelated factors.

In 2000, a Michigan project attempted to modify an industry formula for calculating adequate tech support to the realities of the K-12 world including the fact that multiple people might use a computer over the course of a day. The Michigan Technology Training Resource (http://techguide.merit.edu) instructed school leaders to determine whether their district was "low-tech" or "high-tech." A school that set out to be a technology-rich institution had different needs than a district in which technology played a more subordinate role. In addition to the actual numbers of users, computers, peripherals and operating systems in play, factors such as the age of buildings, the size of the district, the range of technologies and software packages that had to be supported and outsourcing arrangements, if any, would help determine what level of support was a reasonable goal.

Technology leaders in Ohio, using a 2000 survey that found there were 3,384 full-time technical support staff in the state's schools (both paid and unpaid), concluded that the state had a tech support ratio of about one person for every 148 computers. Using the Michigan formula, it estimated Ohio would need to add 3,153 positions to provide what would be considered adequate tech support.

In 2000, the state of Massachusetts determined the average district had 1.5 persons to provide network technology support. It set as a goal that districts should, by 2003, provide one full-time tech support person for every 100 to 200 computers. When the state investigated a year later, however, the trend line had moved in the opposite direction. Statewide, the tech support ratio had grown from one support person for every 358 computers to one for every 439. Twenty-six percent of the districts said they had met the benchmark, but 40 percent reported their ratio fell between 1:200 and 1:500 computers, and another 24 percent reported it was worse than 1:500. Another six percent said they had no tech support personnel.

Massachusetts Tech Support Benchmark(2000)

One FTE for every 100 to 200 computers by 2003

What did districts report a year later?

STANDARD	% OF DISTRICTS
Met benchmark of at least 1 FTE for every 200 computers	26%
1 FTE for every 200-500 computers	40%
1 FTE for every 500 or more computers	24%
No Tech Support personnel	6%
No data available	4%

State leaders speculated in an accompanying report that it was likely that districts had been adding computers without increasing the size of their tech support staff. They also surmised that districts may have actually been doing a more accurate job of reporting their numbers, or had begun implementing other strategies for managing tech support — other than simply adding to the headcount. These might include making use of outsourced support, help desks, posting answers for frequent user problems to a school website, or making greater use of students.

Relying on Students for Tech Support

TASKS	% OF DISTRICTS USING STUDENTS
Troubleshooting problems	43%
Setting up equipment and wiring	39%
Technical maintenance	36%
Assist teachers	5%
Install and maintain software	4%
Network management	4%
Other	4%
Total, Any tast	**54%**

SOURCE: "Are We There Yet," National School Boards Foundation, Grunwald Associates survey, June 2002

Many schools appear to be taking the latter step. A 2002 survey sponsored by the National School Boards Foundation found that more than half of the schools it surveyed relied on students to provide at least some of their tech support. The survey, which weighted its sample toward the country's largest districts, found that 43 percent of districts said they let students troubleshoot hardware, software and network problems; 39 percent used them to set up equipment and wiring; and 36 percent relied on them for network maintenance. Although technology-savvy students can help fill the tech-support gap and develop valued job skills at the same time, districts must make sure that sensitive student records and personnel data are not jeopardized through this approach.

No matter which strategy a district chooses, it's critical to establish benchmarks so that school leaders can evaluate whether new approaches produce the intended results. For instance, when tech support is neglected, the burden of trouble-shooting colleagues' problems often falls on the shoulders of tech-savvy teachers. While a school district may conclude that it is "controlling" tech support costs, in reality it is simply reducing the productivity of its teachers — at a time when they face even more pressures to produce academic "results." By defining standards for response times, for instance, the technology staff can set users' expectations and make adjustments, if necessary, when the standards are not being met.

In a 2001 statewide survey, for instance, California found that just under half of its schools reported that it took two to five days to get hardware repaired and two to five days to get support for technology problems. However, 11 percent of districts reported that it took a month to get hardware repaired and 4 percent said it took a month before tech support could respond. Clearly, districts at that extreme are not getting the return they probably should on their investment. And as the state of Massachusetts noted in a report, echoing the words of one of its district technology leaders, schools can hardly brag about achieving a computer ratio of one computer to every five students if the computers are only up and running 80 percent of the time.

Closely tied to adequate tech support is adequate professional development, a term that can mean different things to different people. Solid staff training usually leads to lower tech support requirements as computer users become better equipped to solve their own simple problems. Although much attention has been focused in recent years on training teachers in how to integrate technology into the classroom, districts need to make sure their technology staff receive adequate training in networking and technology advancements, as well. Technology directors must also find time to keep abreast of new networking products and strategies if they are going to be able to provide good advice to school policy makers.

The requirement that school districts use at least 25 percent of the funds they receive under the new federal "Enhancing Education Through Technology" block grant in the No Child Left Behind Act certainly will help to direct spending toward this important goal. Nationwide, that could represent at least $166 million in additional federal support if schools don't transfer the funds to other programs as they are allowed to do under the law. But in these times of increasingly scarce education dollars, it's important for districts not to simply spend staff development dollars but to spend them well.

While some teachers undoubtedly are still novices when it comes to using technology, the NetDay survey found that nine of out 10 teachers reported they were "comfortable with computers." And it's noteworthy that 67 percent said that while they thought the Internet was a helpful, useful resource, it had not changed the way they taught. Districts must develop strategies that demonstrate to teachers the value of new classroom approaches, that model what this new kind of teaching looks like and that help veteran teachers find the time to retool old lesson plans. A variety of staff development approaches may be necessary including ones that take advantage of online instruction, whether during or outside of the classroom day.

In another example of some of the interesting state benchmarking efforts that have been taking place, Massachusetts set as a goal that every district should have a half-time person to provide curricular support for every 30 to 60 teachers, depending on how much progress it had already made. A year later, it found that 20 percent of its districts had met the benchmark, but that in 25 percent of districts, the ratio was one half-time person for more than 100 teachers, and 16 percent of districts provided no curriculum support of any kind.

A challenge that looms for many school districts a few years down the road is identifying the resources necessary to replace their current inventory of computers when they are at the end of their life cycle. Over the past few years, schools have been installing desktop computers at such a rate that the ratio of students to instructional computers with Internet access has improved from 12.1 to 1 in 1998 to 5.4 to 1 in 2001, according to a National Center for Educational Statistics study released in September 2002. At some point, those computers are going to need to be replaced. Businesses are generally now replacing their computers every three years, and laptop computers every two. Forward-thinking districts appear to be aiming for a five-year refresh cycle, but many districts are not planning at all. Thin-client approaches, in which applications run on central servers rather than desktops, have enabled some districts to keep older machines in useful service for a longer period of time, but these approaches require additional attention be paid to network operations.

Developing a regular refresh cycle and keeping computers standardized on a more limited range of models should help keep tech support and staff development costs lower, as staffs are required to master fewer models and programs and keep fewer parts in inventory. Although computer donation programs have helped many districts acquire usable desktop equipment, technology directors have come to recognize the value of developing a formal policy on the minimum standards for the computers the district is willing to accept. This helps ensure that well-meaning local businesses and community members will not simply transfer their own computer disposal problems onto the shoulders of school technology leaders. New environmental regulations on the proper disposal of used computer monitors, which are considered a hazardous waste, mean school leaders may have to pay more attention to this in the future.

There are no easy answers to these challenges, particularly those that come down to money. Significantly, the language of NCLB requires that states, as part of their new technology plans, explain their "long-term strategies for financing technology" to ensure that all students, teachers and classrooms will have access to technology. The legislation specifies the technology block grant funds can be used for "implementing performance measurement systems to determine the effectiveness of education technology programs funded with this money." Although policy-makers are clearly interested in measuring the extent to which technology has a positive impact on academic performance, the language underscores the importance of developing benchmarks to help measure the effectiveness of expenditures in all parts of the technology budget.

The good news is that the tools available to school districts are improving. The CoSN TCO project is about to move into a new phase as it works with Gartner Consulting to develop case studies, and ultimately a web-based tool, to help school leaders better understand how the business-world principles of TCO play out in the K-12 environment (www.classroomtco.org).

Other organizations have developed complementary tools. The International Society for Technology in Education developed a "Technology Support Index" to help school leaders assess whether they were supporting their networks in the most cost-effective way. This matrix highlights "best practices," and flags those that will require an investment of dollars (http://tsi.iste.org/). In addition, the Institute for the Advancement of Emerging Technologies in Education has worked with several contributors including AEL and Integrated Technology Education Group to create its own TCO calculator tool (available, online at www.iaete.org/ tco/).

With vision and leadership, education policy makers will be able to steer schools into the 21st century with the technologies they implement. But it remains to be seen whether their budgets will follow suit.

Sara Fitzgerald is vice president of communications at Funds For Learning, LLC, and project director of the Consortium for School Networking's "Taking TCO to the Classroom" initiative.

CHAPTER 4
TOWARD A SUSTAINABILITY FRAMEWORK: LESSONS FROM THE LITERATURE AND THE FIELD

BY JULIE THOMPSON KEANE, ANDREW GERSICK, CONSTANCE KIM AND MARGARET HONEY

For many years, educators, funders and the public have looked to technology to revolutionize education. The nation's K-12 schools plunged headlong into the information age, investing heavily in infrastructure, often without developing detailed plans for how technology would support larger curricular goals, how teachers would be trained to integrate technology, or how technology tools would be maintained and upgraded. The necessity of putting technology into schools was widely accepted; How it should be integrated was an open question.

Recent changes in the financial and political climate have resulted in a questioning of the value of educational technology. Is technology having a real impact on our schools? Policymakers and the public want to know if the investments of the past — not to mention continuing investments — are justified.

The justification for edtech, as for all educational reforms, lies in its capacity to improve student learning. We know that educational technologies present some unique opportunities to do just that. Networking technologies offer schools access to unprecedented amounts of information and students and teachers can communicate with peers and colleagues in ways that would otherwise be impossible. Multimedia tools allow students to express more complex ideas in more sophisticated ways. Research has clearly shown that, under the right conditions, opportunities created by technology enhance the learning experience (President's Committee of Advisors on Science and Technology Panel, 1997; Becker & Riel, 2000). At the same time, however, planning for the effective use of technology entails thinking about a multitude of things differently, and districts face new challenges in designing professional development programs, rethinking budgets and reworking curriculum.

Merely purchasing technology resources has not — and could not have — changed the character of education. Instead, looking at the national landscape, we see individual districts where technology investments have been paired with other key elements, like strong district leadership, a defined educational vision with technology serving that vision and thoughtful professional development, to yield observable effects on student learning. We also see many districts that have not brought together all these elements; in these districts, the effects of technology investments are hard to locate. Based on this view of the status quo, we believe the basic question to ask about educational technology is not "Can technology improve student learning?" We already know that technology can help improve student learning. Instead, we must ask, "What conditions need to be in place in schools and districts for technologies to improve student learning?" And, "How can districts create effective technology programs that are sustainable, and be maintained and nourished over time?"

In search of answers to these questions, we first conducted preliminary interviews with individuals in the for-profit and private technology sectors. We then interviewed key stakeholders in three cities pursuing significant implementation of edtech with varying degrees of success: Milwaukee, Chicago and Cleveland. Finally, we convened regional roundtables in New York, Chicago and Washington, D.C., with individuals in the foundation, corporate and governmental sectors who are currently supporting educational technology projects. While conducting this field research, we also reviewed the existing research — our own and others' — on the successes and failures of edtech in the past 15 years, looking for the keystones of successful integration efforts. Finally, we revisited the findings from our 1996 National Study Tour, in which we identified school districts that were

using technology in innovative ways. We looked back at some of the districts from that study to see how they have sustained their efforts to the present day.

We also stepped outside the field of edtech research and looked at other fields for accumulated wisdom about enacting successful organizational change. The integration of technology into education was, after all, supposed to be a change — and a change for the better. Scholars of organizational and systemic change have identified many building blocks necessary to effect organizational change (Kimberly & Quinn, 1984; Nadler & Tushman, 1989; Ledford, Morhman, et al., 1989). The principles outlined in this body of literature match up with researchers' observations of how schools and school districts behave (Morrisson, 1998; Hawkins, Spielvogel, & Panush, 1996). Schools and districts are organizations, and despite all their particular quirks, they share the same basic organizational needs for strong leadership, a guiding organizational vision and healthy structures that enable its members to enact that vision. So organizational theory holds some answers for education.

In this chapter, we present the results of our research as a basic "framework" for successful technology integration. The framework outlines what we believe to be the building blocks of sustainable edtech programs. Certain factors must be in place for a school or district to create a "culture of innovation" — an environment that nourishes positive change over the long haul including the kind of technology integration that can lastingly improve student learning. These factors are each essential to achieving sustained, significant change in any organization. We also suggest indicators of achieving sustainable change that include: institutionalization, a culture of innovation and evidence of effective use of technology.

LEADERSHIP

Complex human systems — including schools — cannot reform themselves without guidance from an effective leader. Significant organizational change must be supported in every relevant aspect of the system (Nadler & Tushman, 1989) and only a strong leader can ensure all the ramifications of change are coordinated throughout the organization.

In business, this pervasive change can mean changing hiring practices, incentives, professional development, grounds for promotion and evaluations of worker performance to reflect the new way that workers are being asked to perform their jobs. Without all of these elements in place, employees will not change their practices. There is no reason to change approaches to a task if promotion, training and evaluation are based on the old standards. Indeed, the old standards will push workers back to the old ways of doing things (Gersick, 1991).

This principle from the organizational literature bears significant implications for any kind of education reform, and illuminates why so many education-reform efforts flounder. If a district asks its teachers to take a new approach to teaching with technology, the entire system must support this new approach and teachers must understand the new vision. Teachers designing new kinds of technology-related lessons need new ways to assess student work that are sensitive to the new skills students will be learning. Their schools need professional development programs that train teachers to integrate new technology tools properly. And both schools and districts need to reward teachers for using technology effectively. Unless all concerned parties have the resources to understand and use information on student technology use, efforts to change the way students learn with technology will necessarily falter.

In short, making a significant change in education around technology requires a concerted, coordinated effort at every level of the education system. A clear demonstration of this principle can be found in the current discourse on accountability and its implications for edtech. After a period of enthusiastic spending on technology infrastructure during the mid- to late 90s, districts and states now find themselves under increasing pressure to demonstrate the impact of technology spending on student learning. What students gain through good technology use are skills such as critical thinking, independent research skills and the ability to communicate complex ideas, and to collaborate with others (Becker, 2000). Yet the only tools districts have to illustrate students' performance are standardized tests that are not designed to measure these kinds of skills. This situation is a classic example of a system embarking on a change and then undermining it with measures that demand the old status quo. Without alternative sources of information and relevant assessments of student attainment related to edtech, policymakers cannot assess its value.

Districts that set out to change the way they educate students with technology — to make a significant change — need effective leaders to guide that change and make it comprehensive throughout the organization.

LEADERSHIP FOR SIGNIFICANT CHANGE IN EDTECH

Effective leaders employ a defined set of skills. Accomplishing significant change generally requires different kinds of leaders at different stages and levels of an organization. Few individuals embody all the qualities identified as indispensable to a successful change process. Yet groups of leaders, each contributing particular skills to a collaborative effort, can effectively lead schools and districts through significant changes. To do so, school and district leaders need to be aware of the skills and practices they must strive for if they are to turn technology integration from a superficial add-on to an element of a significant, embedded change.

Leaders who successfully mobilize people to action, who provide the vision and motivation for change are often called "born leaders" — charismatic figures able to inspire others to action by some rare and ineffable quality. Yet all kinds of school leaders can learn and practice the strategies that catalyze successful change (Nadler & Tushman, 1989). In the context of organizational research, leadership has long been understood as encompassing an identifiable and replicable set of practices (Berlew, 1974; House, 1977; Bass, 1985).

To catalyze significant change, leaders must:

- articulate and communicate a clear and inspiring vision of what that change will entail, and where the organization will be once the change is completed;
- embody the vision in his or her own actions; and
- provide support and understanding to members of the organization as they work to enact the called-for change.

ARTICULATING AND COMMUNICATING THE VISION

In Milwaukee, Wis., where edtech has been part of a successful district-wide mobilization towards school improvement, Superintendent Spence Korté articulated the simple but clear message that Milwaukee Public Schools (MPS) should have "[e]very student performing at or above grade level in reading, writing and mathematics." The goal was not unique — countless school districts have also set their sights on such student performance as a key goal. What was conspicuous was that

Korté emphatically stated and re-stated this goal and called on every segment of the school system to aim its efforts toward the same vision of district improvement. Colleagues cited Korté's ability to articulate a clear direction for the district as key to his effectiveness. Bob Nelson, MPS's director of technology, believes that Korté was an effective leader because he knew how to "boil things down to basics. If you can't boil it down, it's not worth it," Nelson said.

In Union City, N.J., in a district often acclaimed as a national model for school reform and technology integration, Superintendent Tom Highton and Executive Director for Academic Programs Fred Carrigg defined technology as one tool in a concerted effort to promote literacy. In five years (1989–94), Union City went from being the state's second worst-performing school district to scoring up to 20 percentage points higher than urban counterparts on the state's eighth-grade readiness test. And the improvements have continued to this day. Again, the message was simple. As Carrigg put it, "The priority was literacy — you can't do everything at once. It was better to do something concrete that would make a real difference." Technology, therefore, was pursued not as a haphazard accumulation of resources, but as a directed effort at improving student literacy.

EMBODYING THE VISION

CCT researchers visited two middle schools in Salem, Ore., (Martin, Gersick, Nudell, McMillan Culp, 2002), both pursuing technology integration. At "Carroll" Middle School (not the school's real name), the teaching staff and technology coordinator reported the principal's support for their efforts was inconsistent — budgeting, professional development and infrastructure improvements were all handled haphazardly, and teachers were uncertain about what they were supposed to do with technology. At "Jefferson" Middle School (again not the school's real name), teachers and the technology coordinator said their principal was behind them. Indeed, the principal herself stated that technology integration was an important goal for the school. "We've just done things here that have required people to get up to speed," she said. Each teacher we spoke to echoed the view that technology at Jefferson was a tool for helping students create sophisticated project work.

A dramatic example of the different visions embodied by the principals of these two schools could be seen in the kind of hardware each had on his or her desk. While interviewing the technology coordinator at Carroll MS, we noticed she was installing software on three computers that were newer and more powerful than those in the school's computer lab. These, she told us, were destined for the principal's office. Jefferson's principal, on the other hand, proudly told us that she had one of the oldest computers in the school on her desk. She made sure that newer computers went to teachers and the computer lab. Though it may seem like a small gesture, teachers at Jefferson felt that the principal expressed her priorities through her actions.

SUPPORTING THE MEMBERS OF THE ORGANIZATION

In Mendocino, Calif., the Mendocino Unified School District was a success in pioneering technology integration at the time of CCT's National Study Tour of districts using technology in exemplary ways. At that time, we noted the pivotal importance of Superintendent Ken Matheson, who, we wrote:

> was seen as the instructional leader, not as a remote administrator. He wrote most of the grants and fostered the climate that encouraged experimentation with high standards. People told us that they gave up more lucrative or higher status positions elsewhere to come work with Ken.

Matheson served as district superintendent for 10 years — well beyond the average tenure for superintendents in most districts. In taking on the visible role of "instructional leader," Matheson exemplified the leader who embodies the organizational vision. In so doing, he drew talented people to him in a way we commonly associate with charismatic leadership figures. But his charisma was not based in any mysterious quality. Matheson simply made clear to everyone within the organization that he was personally invested in the vision he had articulated for the district. Further, he supported those he drew in. Matheson retired in 1999, but Mendocino retained a healthy, growing technology integration program, thanks in part to the support Matheson provided to others in the district, allowing them to take ownership of a change effort that outlived his departure. When we interviewed Matheson in 2002, he recounted his role in facilitating Mendocino's reforms:

> I was not the prime mover in the sense that my technology skills, even now, are fairly limited. My form of leadership is to give power to others and to encourage them and empower them to be as strong as possible, so [much of the leadership for technology integration] came from the teachers and from others in the district.... I worked with my staff when I was HS principal and with the Board when I was superintendent, to let them know what teachers and administrators were accomplishing and to get their support — to remove obstacles so that teachers and administrators would be able to do the things they wanted to do with technology.

MANAGING THROUGH THE SENIOR TEAM

When an organization seeks to change, the visionary leader who catalyzes change needs managers who can institute the change. One person alone cannot accomplish all the leadership and managerial tasks required to successfully effect significant change. If change depends on one person, what happens when that person leaves? Further, a single individual may be able to impel the motivation for change, but cannot possibly administer all or even most of the structures necessary to enable that change (Kotter, 1998). There need to be coalitions of powerful members supporting the change. This "senior team" of managers creates the structures that clarify the new expectations to be placed on employees. They also administer those structures and the reward systems that accompany them (Lawler and Rhode, 1976).

The power of the senior team managers arises from various sources — reputation, position, relationships, expertise, etc. Though this group is primarily managerial, its members often must provide elements of charismatic leadership as well. Structurally, these leaders administer the mechanisms by which change is achieved yet they must also be seen as embodying the changes to be enacted. After all, why should a teacher believe their school or district is changing its approach to education if they see their vice principal or department chair behaving in the old ways? (Kotter, 1998; Morrison, 1998)

In the districts we studied that successfully integrated technology into a larger educational reform or revitalization effort, the technology directors were members of a senior team working closely with the superintendent to achieve change. Whatever their official title, the individuals responsible for building technological infrastructures, administering professional development and designing technology-related curriculum in these districts were invested with considerable authority in their own right, while at the same time dedicated to pursuing the central vision outlined by the superintendent through technology integration.

In Milwaukee, Director of Technology Bob Nelson is the "edtech manager." While the superintendent provides the district's educational vision, Nelson operationalizes Milwaukee's vision of technology reform. His department has instituted an online "Curriculum Design Assistant" to help teachers in the district design lessons aligned with district and state standards and to share those lessons with other teachers. The technology department of Milwaukee Public Schools has created a tech-support call center that provides advice and assistance on an as-needed basis to teachers. Nelson formed a National Advisory Board of leaders from academia and national business leaders based in Milwaukee to counsel the district on the goals it should be setting for students and the techniques it could borrow from the business world to train and support its staff.

Because Milwaukee Public Schools is a decentralized district, with principals holding the power to make staffing and curricular decisions, Nelson and Korté could not unilaterally impose their technology program decisions on the district's schools. Instead, Nelson had to entice principals to join his own senior team – to become invested in the district's vision of technology reform and interested in forwarding that reform in their own schools. That the district's technology policies became widely institutionalized in schools is testimony to the success of Nelson's efforts. The vision embodied by Korté and enacted by Nelson spread down the chain of command to principals and beyond.

In Colorado's Boulder Valley School District, recognized as a technology leader in CCT's 1996 National Study Tour, members of the instructional technology and administrative technology departments formed an internal "computer cabinet." This group shared leadership responsibilities in technology integration, and ensured collaboration between those who were thinking about technology as a tool for classroom learning and those concerned with using technology to streamline the district's administrative infrastructure. The cabinet gradually dissolved when collaboration between these two departments became routine.

Last year, Chicago Public Schools (CPS) changed leadership at all levels in the district including the superintendent, chief education officer and director of technology. In a new effort to distribute leadership responsibilities for technology integration and to align the use of technology with the district's broad goals for school improvement, CPS restructured their technology department. The district dismantled the Department of Learning Technologies, dividing its responsibilities into the existing departments of Curriculum and Instruction and Professional Development. Director of Technology Elaine Williams and school board member Claire Munani now head a senior team, dubbed the E-Brigade, made up of key leaders from the district including the chief academic officer and the heads of the departments of Professional Development and Curriculum and Instruction. The group has developed a strategic technology plan for the district and assigned key district people responsibility for different elements of technology integration. Chicago is now pursuing the same kind of inter-departmental collaboration that made Boulder Valley a success, but on an even broader scale. Though it is too early to predict the results of this restructuring, Chicago is clearly pursuing a team-management approach to technology.

INFRASTRUCTURE

As technology becomes integrated into the daily functioning of the district, the importance of infrastructure — technical maintenance, financial planning and human resources — cannot be overestimated.

Chapter 3 of this publication provides more detailed information on this topic. As noted by the districts we interviewed as well as the current edtech literature, infrastructures that are somewhat flexible can accommodate potential changes and improvements in a district's vision more easily than rigid ones.

PLANNING FOR AN INFRASTRUCTURE THAT SERVES THE DISTRICT'S LARGER VISION

Districts with whom we spoke talked about the infrastructure planning process as consuming great amounts of time, human resources and money, particularly if districts look upon their infrastructure as a way to help integrate technology into teaching and learning. Incorporated into a district's overall vision, infrastructure and technology can become and — with flexibility, remain — supportive to the practice of teaching and learning (West Ed, 2002).

Technology directors we interviewed kept the following questions in mind as they designed district infrastructure: What kinds of approaches to using technology will further our larger learning goals? What are some indicators of progress toward this end? How will technology help the district manage diverse administrative data and simplify the process of accessing data? (Hoffman, 2002)

In Mendocino Unified School District, for example, teachers and administrators made all software and hardware decisions based on the district's vision of technology's purpose. As former Superintendent Ken Matheson stated,

> I can't remember a time when we didn't have the belief that technology was just a tool – that it wasn't the thing we were trying to teach. We did not believe in the reading programs that were on computers and other rote stuff that was there. We purposely did not purchase those and never did believe that was the useful aspect of computers. We felt that this was a tool for us, not a tool that would dictate what we were supposed to do.

The Milwaukee Public Schools Technology Department made the superintendent's vision — "Every student performing at or above grade level in reading, writing and mathematics" — the message to match and maintain. MPS assembled the Milwaukee Partnership Academy, a collaborative of key local leaders from the business and university communities, the school district and the teacher's union, to create a learning agenda for MPS as well as the community. One result was a technology program with two main goals: to connect and create a community of learners through curriculum innovation, and to support teachers in order to both induct and retain them in the district. With this focus for the department, MPS and the Milwaukee Partnership Academy were able to ensure that its infrastructure enabled future possibilities for learning, and that they could develop systems for integrated management, student data management and professional development.

In addition to broad goals for the technology department, there are many detailed decisions to be made regarding a wide range of programmatic, technical and support considerations such as district Internet policies, standardized network architecture, ongoing professional development and budget concerns (Glennan & Melmed, 1996; Hoffman, 2002; Lathrop, 2002). Current literature about the building and sustaining of infrastructure has noted that it is most convenient and efficient to address these goals during the planning process (Lathrop, 2002).

ONGOING PLANNING

Since all decisions cannot be made at the outset, technology directors with whom we spoke found the most realistic way to manage infrastructure concerns is to revisit and revise their technology plan on an ongoing basis (Sivin-Kachala & Bialo, 2000). Such ongoing planning is conducive to continual maintenance, support and replacement of computer equipment (Glennan & Melmed, 1996). Research in the edtech field supports the tech directors' observations: Schools that allocate time and other resources to the continual maintenance and planning for technology are more successful at planning how best to use technology to improve instruction (West Ed, 2002).

Mendocino attributed part of its success in integrating technology to its planning process — a process that eventually led this small rural district to develop its own Internet service provider. Matheson said:

> Long-range planning was essential for us. We had a five-year plan that we kept updating. The technology committee met at least monthly. We had a coordinated approach to what we did at the schools — our maintenance would be easier if we all had the same equipment.... We really never had funds to do any of this and the thing that allowed us to do it was developing our own Internet access business and the profits of that business went to the district to get bandwidth. It was pretty amazing and otherwise we wouldn't have been able to do it. That took a lot of courage on the part of the board to do that and now [the Internet business] serves about four to five thousand people.

BUDGETING

The single challenge shared by all three school districts we visited in the course of the current study is the challenge of funding. In Chapter 3, Sara Fitzgerald discusses the issue of sustainable financing for edtech programs using the Total Cost of Ownership model. Equally relevant, however, is our finding during this research with the Chicago, Cleveland and Milwaukee Public Schools that all three districts with whom we spoke said they would not be able to maintain their current technology infrastructures without E-Rate funding.

The Chicago Public Schools, a decentralized district, was unable to centralize their application process for E-Rate funding. As described by Elaine Williams, the chief technology officer, "The biggest obstacle to successful wiring was that the individual schools put in their own funding requests and were overseeing their own work..." As a result, CPS is now still scrambling to finish the basic wiring in some schools, while juggling maintenance needs in others. Furthermore, beyond the basic issue of schools still needing to get wired, such duplication of efforts and non-standardization of technology ends up being costly and difficult to sustain, for both technical and instructional supports.

Milwaukee Public Schools, another decentralized district, was able to centralize the entire district's applications for E-Rate funding and was thus able to build a network with sufficient bandwidth to support a growing population of 50,000 users — who use the network at a rate of 11 million hits per day — with few concerns regarding the capacity of its infrastructure. However, although MPS is fully wired, maintenance is an issue. It would be impossible for MPS to maintain its current technology program without E-Rate funding.

Cleveland Public Schools also focuses E-Rate spending on maintenance. Frank DeTardo, executive director of instructional technology, science and mathematics education, says, "[I]f there is no E-Rate money for Year Five, Cleveland will be scrambling to keep that network up. Maintenance is

entirely dependent on E-Rate money." Recognizing the need to create stability in technology funding, Cleveland is in the process of trying to allocate some general fund dollars for maintenance: "It has to be part of the cost of doing business."

PROFESSIONAL DEVELOPMENT

Recent studies have refocused attention on the essential contribution of professional development to the success of technology programs in schools. The Year 2000 Research Report on the Effectiveness of Technology in Schools, (Sivin-Kachala & Bialo, 2000), an examination of over 300 studies of technology uses, found teacher training to be the most significant factor influencing the effective use of edtech to improve student achievement (West Ed, 2002; Sivin-Kachala & Bialo, 2000). Technology has been found to have little effect if teachers are not appropriately trained to use it (West Ed, 2002; President's Committee of Advisors on Science and Technology Panel, 1997; Office of Technology Assessment, 1995; Coley, Cradler, & Engel, 1997; Silverstein, Frechtling, & Miyoaka, 2000; Sandholtz, 2001). Since professional development is so critical, then, what are some key ideas to consider when creating a professional development program?

PROGRAM OBJECTIVES

Professional development around technology generally takes the form of training to help teachers acquire the basic technical skills needed to utilize technology tools, or training to help teachers integrate technology into their classroom practice (Johnston & Toms Barker, 2002). Technology directors with whom we've spoken are in agreement that both technical and pedagogical integration skills are necessary to deploy technology to further students' learning, but different directors do choose various forms for their professional development programs.

What we have learned from our own and others' research is that training around basic skills need not focus on basic skills. Current edtech research indicates that many teachers who have participated in training that concentrates on basic skills find it too limited to be helpful (Hawkins, Spielvogel, & Panush, 1996; National Center for Education Statistics, 1999; President's Committee of Advisors on Science and Technology Panel, 1997; Office of Technology Assessment, 1995). For example, the Rhode Island Teachers and Technology Initiative (RITTI), sponsored by the Rhode Island Foundation, began with the goal of helping teachers become more comfortable with technology. Although some programs might interpret such a goal as targeting basic skills, the initiative viewed teachers as a critical catalyst for enabling innovative reform and therefore focused on helping them develop curricula, collegial and professional connections, as well as personal and professional productivity (Henríquez & Riconscente, 1998). With this focus on teacher professional development beyond basic skills, RITTI made an impact on teachers' attitudes, behaviors and relationships that has been sustained beyond the duration of the initiative. In Chapter 5, Ron Thorpe discusses at greater length the idea of sustainability as "the residue of serious learning."

We also find that professional development, like all other programs in the district, is most effective when it is congruent with the school vision (Hawkins, Spielvogel, & Panush, 1996; Martin, Gersick, Nudell, McMillan Culp, 2002; West Ed, 2002). The Cleveland Technology Department, for example, sees technology as an integral piece of teaching and learning, and believes that professional development is the means to help educators learn and think about, as well as integrate, technology into their teaching. "That's sustainability — when everyone expects technology to be part of

lessons." But helping educators see the potential for technology integration is sometimes difficult, in Cleveland's experience, because technology, according to some of the more traditional educators' perspectives in Cleveland, is separate and distinct from standard teaching curriculum.

INSTRUCTION

Technology directors who feel they have been relatively successful integrating technology into the classroom have told us that the most important staff-development features helping teachers in this endeavor include opportunities for exploration, reflection and collaboration in authentic learning tasks and hands-on learning (Sandholtz, Ringstaff, & Dwyer, 1997; Sandholtz, 2001). Teachers develop technology skills most effectively through lessons that enable them to integrate technology into a piece of their own curriculum — a piece of work in which they feel invested (Martin, Gersick, Nudell, McMillan Culp, 2002; President's Committee of Advisors on Science and Technology Panel, 1997).

Deena Zarlin, a former Mendocino teacher who now works with the district to develop technology-rich community service projects as part of the North Coast Rural Challenge Network, agrees with these findings. "The first step is that [teachers] have to have time to play, themselves, to get a comfort level with the technology themselves. They have to see reasons, personally, why technology is useful."

PROGRAM STRUCTURE

Edtech literature emphasizes the importance of providing ongoing support when helping teachers use technology to enhance student learning. Professional development, structured as "a planned, comprehensive and systemic program of goals-driven activities that promote productive change in individuals and school structures," fosters and supports behavioral and attitudinal changes (Bellanca, 1995). This kind of professional development requires more than one or two days of in-service training (President's Committee of Advisors on Science and Technology Panel, 1997). Students of teachers with more than 10 hours of training in edtech have been found to significantly outperform students of teachers with five or fewer hours (West Ed, 2002; Sivin-Kachala & Bialo, 2000).

Making professional development available for teachers when it is most relevant and critical to their teaching was a priority for several of the technology developers with whom we spoke. Mark Schlager, developer of the educational online community Tapped In, finds technology to be particularly effective in "creating a critical mass of what you need to support teachers at any given moment." The districts where we have seen relatively successful integration of technology into curriculum acknowledged and addressed both the amount of time teachers need to understand and integrate technology into their teaching, as well as the amount of ongoing support – both technical and pedagogical — teachers need for successful integration (Hawkins, Spielvogel, & Panush, 1996).

Mendocino, a small district with a high commitment to quality technology use, provides ongoing professional development in the form of one-on-one support. Said Ken Matheson:

> We have people that can follow the professional development up in the classroom. For example, with the Internet, we were one of the first schools that got online, and we did it districtwide. We were working with teachers in a very intense way and we were able to free up one teacher to do large in-services, but then that person also worked with them in their classrooms.... Internet became a very natural part of how we operate in our schools. We said

> that we will go the extra mile to help teachers — go into their classrooms, go to their homes — and you can't stop doing that. It's not easy to keep that going with the economy getting worse, so you have to have the leadership that's willing to find the funds to keep that going.

Though few districts are small enough or focused enough to make house calls, districts may be able to find ways to make ongoing professional development respond to teachers' needs as they arise. Fortunately, technology not only creates professional development needs; it also has the capacity to address them. Tapped In, an online professional development support structure on which multiple organizations can share knowledge, is designed to help increase the capacity of organizations to provide ongoing professional development. Similarly, Milwaukee Public Schools is developing a "professional support portal" to help MPS's professional development program address the district's high rate of teacher turnover. It is a scaleable project that addresses the entire system and aligns to the needs, as well as the vision, of the district. Like Tapped In, it utilizes technology to bring colleagues together and enable them to share ideas and mentor each other as only technology can.

BUILDING A COALITION OF STAKEHOLDERS

Education has multiple stakeholders including school boards, teachers and administrators, unions, local parent groups, corporate and other community interests, not to mention state and federal government involvement. This very complicated political landscape is what school and district administrators must navigate to meet the needs of their various constituents. Supporters of technology integration must find avenues to communicate the motives and results of such an effort to stakeholders. This means first gathering credible evidence of the effects of technology on student learning. It also means articulating the arguments for technology's value to the overall enterprise of education.

The success of organizational change is measured not only by goal attainment but also by the perceptions of the constituency. "It's not enough to attain your goals; the constituencies of the organization have to actually agree that the organization is delivering value" (Foundation Center, 2002). This has been a challenge for many school districts because in many ways it's a public relations issue. As Bob Nelson asked, "How do you tell the story about how technology impacts learning and make it stick?"

BUILDING PARTNERSHIPS

School districts have long understood the need to develop partnerships in order to sustain their work. Milwaukee Public Schools uses partnerships, created for different initiatives, to develop new ideas and build support for their agenda for school reform and technology. Bob Nelson worked closely with business leaders to build MPS's data management system based on best practices from industry. Collaborating with the business community gave Nelson access to industry wisdom; it also lent the weight of business-world credibility to Nelson's reform efforts. "Having members of the business community standing behind me allowed me to ward off detractors," Nelson explained. More recently, MPS established a Partnership Academy that includes key leaders from the University of Wisconsin, local business and the school board, and has been instrumental in supporting MPS reforms. MPS also convened its National Advisory Board of academic researchers, policymakers and business leaders to guide the district on effective pedagogical practices, education policy and innovative uses of technology. Bob Nelson described this relationship as symbiotic: "We can be a test bed for national people to look for effective practice and MPS benefits

from the experimentation. What we gain from them is guidance for every step."

STUDENTS AS STAKEHOLDERS AND ADVOCATES

Students are the school system's most important stakeholders, yet they typically have little say in how schools work. Even so, students can be advocates for technology, through their parents and the work they do in their community. The Mendocino school district is a good example of a community that has been influenced by the input of its students. "Our local board and our community don't need to be convinced [of technology's value], because they talk to their kids, who come home and [tell them] about what's going on in school," Ken Matheson explained. Mendocino residents also see the value of technology in student work that directly impacts the community:

> Kids are involved with the community through projects and usually these projects involve developing an end product that is important to the community. For example oral histories are big projects in the schools. [Students produce] CDs for that and go through the whole printing process as well. They developed a product for the oral history and then had a community gathering to disseminate it. And sales of that product will help pay for the next project.

UNDERSTANDING THE POLITICAL ENVIRONMENT

School districts constantly must attend to and reevaluate the political context in which they operate. Prior to the passage of the federal No Child Left Behind (NCLB) legislation, most funds for edtech were distributed at the federal level. These funds are now being given as block grants to the states, which are now responsible for their distribution. Many state legislators need time and guidance in this policy area, which is often quite new to them. NCLB also allows state education policymakers to shift money to other programs — an extremely tempting option as state budgets shrink. It is therefore essential for school districts to advocate for their programs at the state level. "I have built new relationships and found allies at the State Department of Public Instruction," Bob Nelson said. "My communication and coordination with the state has increased significantly since the passage of NCLB."

As was noted in chapter 2, in Illinois, edtech programs have been cut more than other education initiatives because legislators have not been convinced these programs are necessary to Illinois' educational goals. Bindu Batchu from the Metropolitan Planning Council (a nonprofit, nonpartisan group of business and civic leaders serving the Chicago area, promoting the public interest through urban planning and policy development) pointed out, "Since 1998 there has been no increase in funding. Districts could not make a case for it statewide. We took a big hit to education technology — 28 percent was cut to the funding — highest percentage cut in the Illinois education budget. A big chunk of that was direct funding to school districts; now it could be as much as a 50 percent cut."

The council's report, *Education Technology: Developing an Education Technology Agenda for Illinois,* enumerates the needs for educational technology funding and how important these programs are for the Illinois public education system (Batchu, 2002). Groups like the Metropolitan Council are important in advocating to (and educating) state governments and other stakeholders about the importance of edtech programs and their fundamental role in school reform. However, school districts will also have to assume this active role in order to persuade state and local legislators about the necessity of edtech funding.

ASSESSMENT FOR CONTINUOUS IMPROVEMENT

To develop a comprehensive and effective technology program that serves the overall educational vision of the district requires new ideas and experimentation. Several school districts with successful technology programs designed smaller projects or testbeds that enabled them to learn and revise, providing them with the opportunity to judge the merit of their investments before implementing larger initiatives. By developing structures to receive this timely feedback, the district develops a mindset that technology isn't just about implementation but about continuous improvement.

The organizational literature refers to these structures as learning systems (Light, 1998). This is distinguished from the learning organization (Marquardt, 1996; Senge, 1990), which refers to the organization as a whole including the leadership, internal management systems, etc. A learning system sets up formal and informal structures that allow the organization to learn and ultimately inform organizational decision-making. Both Milwaukee and Chicago have established mechanisms to receive ongoing feedback in order to refine and improve existing professional development programs, and created testbed programs to experiment with new models for professional development.

Milwaukee: Focus Groups

One strategy we learned about in Milwaukee is the use of regular focus groups with teachers and administrators. This gives district coordinators the opportunity to ask important questions: "Are we getting this right? Is this program making a difference?" Focus groups are conducted at the beginning of any initiative; as Bob Nelson explained, they involve "a lot of listening and getting thoughts on pieces [of the program] that are created." This gives the district ongoing formative feedback, allowing the district to assess which programs are worth keeping and which are no longer serving a purpose. According to Nelson, the result of this process is that "[The district] is behaving like a service organization" — a learning community is created between the district, school administrators and teachers. This is particularly important: As teachers become more experienced technology users, they will need additional, more nuanced, professional development opportunities.

Focus groups were also conducted when the district and Marquette University received a federal TLCF grant that allowed MPS teachers to take online university classes. They created what Nelson described as "special learning groups." These consisted of teachers from across different schools and grade levels brought together to discuss how the program could better address the ongoing professional development of the participating classroom teachers.

Chicago: Greene Technology Training Center (GTTC)

Region Four of the Chicago Public Schools established a technology training center (TTC) at the Nathanael Greene Elementary School during the 1999–2000 school year, in collaboration with the Center for Children and Technology and with funding from the Joyce Foundation. The goal of this project was to offer teachers in Region Four an opportunity to observe, collaborate and learn from other teachers with some experience in using technology in their classrooms. Although CPS teachers have many existing opportunities to attend workshops to help them develop needed technological skills, the bigger challenge facing teachers is discovering how to translate those skills into the classroom. This program was an enormous success within Region Four: over 25 schools sent teachers to the center throughout the 2000–2001 and 2001–2002

school years. Plans are now in place to establish TTCs throughout the district, though this has been delayed due to the appointment of a new superintendent and a change of key management personnel at the district level. Establishing the program in one school allowed the district to experiment with a new model for professional development before attempting large-scale implementation.

INDICATORS FOR SUSTAINABILITY

In the previous section we outlined the building blocks that districts need to have in place to fully take advantage of the opportunities technology provides for education. But, some key questions remain.

How will districts know they have developed a sustainable edtech program? What does a sustainable program look like? What evidence should a school district collect to show that its investments in technology have paid off? What does the district need to communicate both internally and externally to prove that its investments should be maintained as a core investment, necessary for the functioning of the school overall? To achieve the ultimate goals of improving student achievement and teacher performance and quality, school districts must do the important work of defining success.

Informed by our current and previous work, as well as literature in the field, we found three indicators of effectively integrated technology in a district. They include the development of a culture of innovation, institutionalization of edtech, and gathering and communicating evidence of effective use of technology.

DEVELOPING A CULTURE OF INNOVATION

The relevant organizational literature on government and nonprofit organizations contends large bureaucracies are hostile to innovation (Holdaway, Newberry, Hickson, & Heron, 1975). This literature does not exclude the possibility of innovative cultures, but implies that innovation more frequently arises from a single innovator's singular performance. While our observations support the idea that strong leaders catalyze change, the best leaders quickly distribute responsibilities for enacting that change to members at all levels of the organization. In our prior and current research, however, we found that school districts with sustainable technology programs have created a culture of innovation. These schools tend to have the unique combination of very effective leadership and strong management. Thus, the shift in district culture may begin with a single innovator – and a single innovation – but it spreads throughout the district so that innovation occurs at all levels of the system. This is due in large part to an attitude, embodied by the leader and management team, that embraces creative, strategic thinking and thus encourages new or revised approaches to the same tasks.

These districts and schools create environments in which teachers, students and administrators feel comfortable experimenting (Light, McDermott & Honey, 2002; Hawkins, Spielvogel, & Panush, 1996). Union City teachers, for example, have developed an approach to technology innovation that puts students at the center of the teaching and learning process. In other words, they have reexamined the traditional role of teachers imparting knowledge upon their students; instead, they experimented and ultimately had success with giving students room to explore the ways in which technologies can be used to further the district's teaching and learning goals. Thus, students work with teachers to develop web-based instructional materials and presentations (www.union-city.k12.nj.us/school/ehs/rtc03/index.html) and create technology resources that support innova-

tive programs such as the district college initiative known as Road to College.

Students work during the summers with a variety of community-based organizations to build websites or update and modify these organizations' existing resources. Students also participate in a teen tech program that troubleshoots technology problems and provides ongoing maintenance and upgrades to computer equipment. Having learned that students, when given the room to explore technology, continue to experiment and build upon their existing knowledge, teachers now often turn to their students for help in using and learning about technology.

During our 10 years of researching in Union City we found that one innovation – such as the above-mentioned change in curriculum – can ultimately lead to change and innovation in many areas of teaching and learning. For Union City, re-thinking its curriculum inevitably caused a re-examination of professional development. But in order for the revised professional development to be effective, individuals in the district had to be open to change. Thus, the work of building a culture of innovation began with this single change. Once that culture was established, Union City had the capacity to realize new opportunities that could be applied to any area of teaching and learning. Bob Nelson of Milwaukee described this process well: "The unanticipated result [of a successful program] is a change in institutional culture."

During our discussions, both funders and district technology leaders agreed that effective use of technology has the potential to be one step — or perhaps even the first step — in the process of creating a culture of innovation. In order for technology to even have the potential to be such a step, teachers need to feel they have sufficient autonomy to learn about it and implement it in their own way. An example of fostering such autonomy happened in Milwaukee Public Schools. Milwaukee holds technology fairs for hundreds of local teachers to showcase technology projects they conducted in their classrooms. The fair demonstrates and recognizes teachers' pursuits of their own small technology innovations, and thus reflects the district vision for technology integration by individual classrooms. In addition, it also demonstrates their ability to affect vision rather than just accept it from district administrators. These teachers, in other words, are not only asked to innovate, but their innovations are also taken seriously.

In Mendocino, former superintendent Ken Matheson prioritized the creation of an environment where teachers and administrators could experiment. "I had to get the obstacles out of the way so they'd be free to experiment. We met with parents to let them know what we were doing, met with the board to let them know what we were doing, facilitating the whole process." Ultimately, Matheson found that teachers became the real drivers of innovation. "They knew they could take the risks, they knew they could try things and experiment — that was encouraged. They were their projects. They became the experts and were able to teach each other."

This ability to create a critical mass of innovators within the district remains a key component for sustainability in Mendocino. A small district that often lacks sufficient state and federal funds to support its initiatives, it is forced to seek outside funding for their core technology programs — and relies heavily upon its teachers to help in doing so. According to Mendocino Technology Coordinator Deena Zarlin, "[There is] just the entrepreneurial spirit of teachers to go after grants or new programs — a climate of innovation that is supported. So you can have an idea and go after it. We support them in pursuing it."

INSTITUTIONALIZATION

Institutionalization means that a change has become pervasively routine. When technology programs are institutionalized, they are a given — like textbooks, chairs and desks — that no longer have to be justified to the stakeholders. It is understood both within the district and in the community that edtech programs should be sustained because they are an important part of their overall educational vision.

One key ingredient necessary for institutionalization, structural change, is that technology becomes embedded in all departments in the district. In the last year, for example, Chicago dismantled its Learning Technologies (LT) department and placed its programs into existing departments such as Curriculum and Instruction and Professional Development. This was done because LT was considered a separate, distinct department — and therefore less critical to the district vision — than other departments in the district. Many technology projects were perceived as an add-on to the district's core educational programs, undermining LT's abilities. "I wanted technology to be embedded in everything we did," explained Director of Technology Elaine Williams. "I found that we had the Learning Technology unit that was doing something but then Curriculum and Instruction was doing something, others were doing something — and I wanted to send the message that technology was fundamental to everything we do, so that's why the people working in LT are now working in all these other departments."

Cleveland Public Schools underwent similar restructuring. According to Frank DeTardo, "One of the simple things we did was bring instructional tech under the academic officer's department and create involvement with curricular areas. We also convened [a meeting] to include technology pieces into the math, science and language arts standards." Now that Chicago and Cleveland have restructured their programs, only time, resources and energy are needed to make the restructuring become truly integrated.

For the Mendocino school district, edtech has been effectively institutionalized: It is part of their core educational program and part of their "routine." According to Deena Zarlin, "We don't feel pressure [to justify or cut technology programs] because it's just so much a part of what we do that nobody would think to look at that one piece and ask why. We're not using technology for its own sake, we're utilizing technology to write reports, research, create projects — nobody would say how does the pen impact the report?"

Evidence of institutionalization in Mendocino through personnel was articulated by Ken Matheson, "Several key players that believe have fortunately stayed in the district. [However] if they leave, it'll continue on, because it's so ingrained in what we do. As far as administration is concerned, there's been a 100 percent turnover since I left in 1999 and the commitment to using technology in that way is still there."

Although the integration of technology in teaching and learning in the schools is obviously critical, it might also be bolstered significantly if funders begin to integrate technology in their own programs. From our discussions with funders, we learned that many foundations consider edtech as separate from their larger school reform agenda and therefore either fund it as a separate program, or don't fund it at all. For example, a program officer from the Chicago Community Trust lamented that the trust has not seen the importance of embedding technology into its three education priorities: literacy, professional development and innovative change in school organization. She, as well as many other foundation representatives, believes "technology is the underlying infrastructure that needs to be part of those efforts for school change."

Integrating edtech into funding programs may be a critical element of changing the way schools envision projects that involve technology. Doing so would encourage schools to integrate technology into their programs at their outset, rather than adding it on as an afterthought. Another roundtable participant voiced her agreement: "The key piece to sustainability is how we define education technology and the paradigm we're using. We need to talk about school reform as the main issue. If we keep speaking only about educational technology, we're going to keep being questioned."

GATHERING AND COMMUNICATING EVIDENCE OF EFFECTIVE USE OF TECHNOLOGY

Technology tools can improve student acquisition of basic skills (Mann, Shakeshaft, Becker, & Kottkamp, 1999). They can support student understanding of complex problems as well as promote higher-order thinking skills and problem-solving abilities. Additionally, technology is being used not only in the classroom, but is revolutionizing the way school districts do business, from financial management to student data collection and sharing.

Districts must articulate how important maintaining and sustaining technology infrastructure is to their work, and must also be able to show evidence of effective use of technology to multiple audiences. Scores on norm-based tests, which may be important to policymakers, cannot measure the effect technology had upon students' knowledge. Many educators feel that technology provides the opportunity to make students more active learners, a benefit of technology that is not measurable through standardized tests (Hienecke, Blasi, Milman & Washington, 1999). Thus, the Mendocino School District, which values the impact technology has had upon its curriculum, shows its strong commitment to technology and a progressive curriculum by using multiple measures for assessment, going beyond standardized test scores.

The district also forbids test scores from determining the design of its edtech program. As Ken Matheson explained, "We take the position that the kids involved in project-based learning — their scores will eventually do better. The tests test such a small amount of what the kids need to know and do. The parents intuitively know that, so it hasn't lessened our ability to do PBL [project-based learning] or use technology." He continued:

> The things that happen with technology and project-based learning are so far beyond what the standards cover — their use of information from different sources to create other, new information, developing products that they can show to an audience wider than their classroom — the standards don't even come close to addressing that. So you have to be able to overcome that and be willing to take a stand, both personally and as a district and to say, "We can do better than that, and our kids can do better than that — and we want our kids to learn the important stuff."

How effectively districts and schools communicate their vision and goals for edtech — and then support this vision with evidence of achieving the goals — will determine the sustainability of educational technology. Communicating this information, however, is a difficult enterprise. Education systems are complex, and isolating technology as one variable that affects student learning is almost impossible. The challenge for school districts, policymakers and researchers is to give evidence of effective technology use while reflecting the complexity of the school system.

This challenge is only heightened by the lack of adequate generalizable assessments in place to capture student learning around

technology that is integrated into project-based curriculum. Business and national education policy groups (NCREL, CEO Forum, AOL Time Warner Foundation, Bertlesmann) are calling for new assessments that focus on the 21st century literacies students need to be productive citizens in the Information Age. Creating and implementing these assessments is an essential step in providing school districts with the tools they need to represent what their students are learning and also to sustain their edtech programs.

CONCLUSION

In a climate of smaller state and local budgets, less federal support and increased skepticism about technology's impact, educators need to know how their schools and districts can capitalize on technology's promise to improve teaching and learning. We hope this framework provides some guidance to school and district leaders wishing to catalyze and institutionalize successful education reform with technology. The building blocks outlined in our framework can help educators think strategically about where to direct their resources to create environments that will support and sustain effective edtech programs.

Andy Gersick is Senior Research Assistant, Center for Children and Technology

Constance Kim is Research Associate, Center for Children and Technology

Julie Thompson Keane is Associate Project Director, Center for Children and Technology

Margaret Honey is Director, Center for Children and Technology

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CHAPTER 5
GETTING THE CENTER TO HOLD: A FUNDER'S PERSPECTIVE

BY RONALD THORPE

Why do some things take root and grow while others barely break the surface? How long does something have to be around before we can declare that it's here to stay? What has to happen in order to transform an oasis of change into an entire landscape? These questions frame the dynamic people refer to as sustainability. And it would be hard to find a dynamic that is more elusive, tantalizing, full of promise and frustrating, especially in public education where we have national expectations, state responsibility and a local approach to getting the job done. With so many masters, so many demands and so much history and tradition, how can new ideas get to the center of this enterprise we call school? And how can they stay there?

Nowhere is the concept of sustainability more challenging than in the area of computers and information technology where costs are so high. The initial investment in the equipment is great, the ongoing costs of upgrades and replacements are great, and so too are the costs of training. In a system that is accustomed to purchasing items with at least a decade of shelf life and little or no professional development components, the shock goes beyond the sticker price.

Justifying these costs is another challenge. Unlike previous technological innovations that were designed simply to help teachers do faster or more easily the work they had been doing previously (e.g. overhead projectors, copying machines, VCRs, calculators), this technology actually allows teachers to imagine the work itself differently. Consequently, adopting this technology requires not only an understanding of how the equipment works, it asks teachers to rethink their basic relationship to the who, what, why and how of teaching and learning. That frontier remains largely unexplored. PowerPoint presentations and drill-and-kill remediation don't begin to justify the capital and human investment the technology requires.

RETHINKING OUR BASIC RESPONSE TO THE SUSTAINABILITY CHALLENGE

In the most basic sense, when people use the word "sustainability," they are referring to the capacity to keep some program going, which we typically understand as an additive process. If a school budget is X, and a new program designed to improve literacy, for example, costs Y, then the sustainability challenge requires revenue to cover the new budget that is now X+Y. If that is our only vision of sustainability, however, we are dooming most new ideas to the dustbin. No organization can afford to keep adding programs and finding ever-increasing amounts of money to keep everything afloat.

Yet that hope fuels most innovation. My work in foundations and schools has allowed me to observe and even contribute to the benignly naïve way people approach sustainability. I have read hundreds of proposals, and I can't remember a single one that didn't promise that it would result in work that would be sustained. Most of these innovations have a brief and valiant life but seldom live beyond the hearts and minds of a few zealots who believed in them in the first place.

There is no question that sustainability is a worthy goal, but maybe our vision — the one that starts with the notion that change occurs through the addition of new ideas and becomes a permanent fixture when there is an expansion of resources — is just too incomplete.

TWO WAYS OF THINKING ABOUT SUSTAINABILITY

I would like to suggest two approaches to sustainability, which could help schools and funders. The first looks at sustainability in the traditional sense — building a new program that becomes embedded in the life of a school or district — but asks for a more deliberate effort to plan for the future of that program beyond the term of the grant that

launches it. The second requires an understanding that goes deeper than the basic structure of a new program and the service it is designed to deliver. It acknowledges that not all things need to be or should be sustained, and directs the parties involved to look for those essences that stay in a school culture after the program has gone.

Both approaches begin with a "given," namely that the amount of money available to cover the annual operating expenses for schools is not going to change much. Of course, an increase in financial support for education would be wonderful, but I prefer to start with the premise that such increases will not be there in the foreseeable future.

THE TRADITIONAL VIEW OF SUSTAINABILITY IN SCHOOLS

Ideas about change often begin with a person or group of people within a school who build a program that promises to be the catalyst for the change. A proposal is written describing the program's potential and how much it will cost, and that proposal is sent off to one or more sources of new funds. By their nature, funders — whether governmental agencies, private foundations, corporations, or even individuals — want to help new things get launched. Except in rare instances, even the most generous and patient funders will not stay with a program forever.

Knowing that continuing funding is unlikely, the grant seeker presents a plan for how the program will be sustained once the grant period is completed. These plans generally take one of two forms. The first is little more than a description of how other grants will be secured, which only begs the question of sustainability. The second is usually the heartfelt hope that the institution will incorporate the costs into its operating budget.

It is actually within that second response, where the only real possibility for this type of sustainability exists, but the eventuality of it requires more deliberate planning than typically occurs. Basically, in order for a new program to become a line item in the current operating budget, it will have to replace something else. From a rational point of view, given that the human and financial resources of a school are relatively finite, such an assumption makes sense and ought to win the day. But from a political point of view, taking away anything within a school is problematic because so much of the culture is win-lose: If you win some resources, I'm going to lose some resources. And there is no question that the forces assembled on the side of protecting the current distribution of resources almost always defeat the bright-eyed folk trying to change that balance. Knowing such obstacles exist, most innovators try to maintain the current conditions and simply add the new idea to the mix. Such plans seldom work. An add-on is an add-on and too easily dismissed or too easily relegated to the single classroom where the innovative teacher works overtime and in complete isolation from the rest of the system.

Given such a gloomy scenario, where is the possibility for change in the system? The answer lies in understanding growth not as "getting bigger" but as "getting better." The viability of any new program should be assessed initially not only according to what it will add to the system but according to what it will replace. Such an assessment should include an analysis of the operating dollars currently being spent on the program or pieces of programs that will be no longer necessary if the new program works. There needs to be a commitment from everyone involved in the old program that those funds will be shifted to the new program if that program succeeds. If the old funds do not quite close the gap, then another layer of commitment needs to be secured, but the

bottom line is that the money must be found within the current operating budget and not simply hoped for from additional grants. The role of the grant, then, is R&D, venture capital, the money that is put out there in order to test the validity of the new idea. The school or district should not be expected to put up that kind of money — that is the preferred role of foundations, corporations and in some cases the government — but all parties should insist on seeing the whole calculus before anything gets started.

The following illustrates this point. In an urban district, certain school leaders are convinced that getting teachers to develop web-based curriculum and instruction will help improve student achievement because of the different ways students can be engaged in their learning, but there is no money in the current budget to cover the costs of training and equipment. The leaders in the district work out a plan including the costs, for introducing this new pedagogy on a "pilot" basis. The next step is to analyze the current budget with the goal of finding those line items that would be no longer necessary, or at least less necessary, if the new plan succeeds. In this case, the planners identify the costs of textbooks, teacher guides and work books, all of which can be relegated to secondary resources if the web-based teaching becomes primary. Although the money saved is not enough to cover the up-front costs of training, equipment and development, it does cover about 80 percent of the ongoing costs of maintenance, replacement and training. With that information in hand, the leaders have a strong argument to take to funding sources.

An important part of this analysis is the establishment of a timeline and the benchmarks that will be used to assess how closely the reality of the program matches the initial promises, and also a model for taking the pilot to scale districtwide. If the pilot meets its goals, there is already a plan in place for where the sustaining financial resources will be found. If it falls short, the designers will have to decide whether further development will improve the situation or whether the original idea simply was not as sound as they thought. Whatever the result, the work is informed by a level of intelligent intentionality that respects both the need for constant improvement in schools and the limited resources that are available.

Even under such rational conditions, the political dynamics within the school environment do not go away. Those who believe their livelihood is dependent on maintaining the status quo will find plenty of ways to make sure the plan does not succeed. But those variables need to be factored into the planning process.

One additional word about the relationship between grantor and grantee around these issues. I have no idea where the magic number "3" came from, but there is no reason to believe anything of real consequence, especially in matters related to organizational culture, can be accomplished in the normal funding cycle of three years. I suspect decisions regarding the right term of investment should be made ad hoc based on what people are trying to accomplish.

A LESS TRADITIONAL EXPLORATION OF SUSTAINABILITY

A second and less traditional approach to thinking about sustainability looks beyond the program itself to understand what engagement in that program does to human behavior and the basic relationships that define an organization's culture. Such a framework of understanding is similar to what Ted Sizer identifies as "habits of mind" or "the residue of serious learning." Sizer asks the education community to understand its work beyond the standard content of curriculum — the facts and figures — in

order to ensure students develop habits that will serve them through a life that holds challenges and opportunities barely imagined. These habits, he maintains, are the things people reach for when they have forgotten the date of the Boston Tea Party or no longer remember the conjugation of irregular French verbs. Powerful learning experiences reach into the roots of people's deeply held belief systems, test them, and either strengthen those beliefs or alter them.

An example. A foundation made a grant of $6 million to provide laptop computers and training to 2,500 public school teachers in one state – 25 percent of that state's K-12 teaching force. The goal was to get more teachers skilled at using computers and information technology. The project took three years and was created because it appeared too many computers were sitting idle in the schools simply because teachers did not know what to do with them. While there was the hope some entity would be so impressed with the results that it would cover the costs of at least the training, if not the computers, for the remaining 75 percent of the teachers, the foundation was content from the beginning not to demand such a commitment. When the initiative ended — or at least when the grant was spent — there were continuing efforts to keep the momentum going, but not in a way that would lead to 100 percent coverage.

From a traditional perspective of sustainability, an assessment of the foundation's investment might not look too good. All teachers still are not using computers in their instruction of students, and there is no statewide plan to ensure such a thing.

But from another perspective, the conclusion is different. The initiative led to a shift in the basic culture and expectations of a critical mass of teachers, not only in their use of computers, but in their attitude toward professional development, teaching and learning. Teachers report they are choosing to stay in teaching beyond the point when they can retire simply because they are now so reengaged with students and their own learning. Teachers are more connected to each other, more apt to seek out leadership roles. They report seeking more professional development opportunities than they have in the past, being more involved in creating their own curriculum, being more likely to make major changes in the basic way they teach, typically shifting more responsibility to the student. The program the foundation created is not being sustained, but the impact of the program is being sustained and expanded through the changed expectations and behaviors of individual educators.

There are two other aspects of sustainability that need to be considered. First, nobody has put an actual date stamp on the length of time something must exist before we declare it sustained. Do we mean five years? Ten years? Fifty years? The question itself points out the flaw in the thinking because, of course, there is no answer. Second, imagine the stultifying atmosphere of a school if it were defined entirely by programs created by previous generations. It seems healthy that each new wave of teachers and students would want to reinvent their school, to put their personal mark on the place. If the only thing they have time and resources for is shouldering the creations of the past, we condemn the institution of schooling to a dreary fate.

I offer one final example of how sustainability can be misunderstood. A distinguished former leader of a secondary school once told me that 10 years after he left the school, only one of the many programs he started was still in existence. His tone implied a degree of failure. Yet, taking a more objective look, the school has continued to grow in vital ways, has built on the

new expectations it has developed for itself, and apparently is well equipped to tackle the challenges it has faced in subsequent years. On every measure, the school is a robust learning community meeting the needs of a new generation of students. So, should the funders of all those now defunct programs feel their money was poorly invested? Clearly there was some important essence that carried on, some institutional "habits of mind" that transcended the programs and lodged in the soul of the place. In real ways, those programs were the means by which the faculty and students came to understand and operationalize their broad system of beliefs about the purpose and possibility of their school and to alter them as time and conditions changed.

It is appropriate that we put a high-powered lens on issues related to sustainability. In the process of doing that, however, we need to know as much as possible about the subtleties and texture of what we mean by sustainability and what it is we are hoping to sustain. We need to address sustainability in a more technical and precise way, but we also need to stretch the canvas of our understanding so we capture all of its possibilities. If the center of education is to hold, it must be able to accommodate a constant examination of what it now contains and how new ideas can replace old ideas. Working together, funders and schools and other organizations can use this exploration to everyone's advantage and especially to the advantage of the children to whom the entire enterprise is dedicated. For their sake, we need to sustain our interest in sustainability.

Ronald Thorpe is senior fellow at the Rhode Island Foundation. He is a former teacher, district administrator and the editor of "The First Year as Principal."

CHAPTER 6
EDTECH IN INDIAN COUNTRY

BY KADE TWIST

The schools of Indian Country, like so many schools across rural America, are in the midst of a critical transition period regarding education technology.

Setting appropriate spending priorities that will allow schools to build the capacity to sustain their technology investments has proven to be a challenging task. For schools in Native American communities, funding priorities that place an emphasis on hardware purchases rather than professional development and capacity building have adversely affected school-level efforts to sustain technology investments. This problem has been further complicated by recent federal and state budget cuts, putting more responsibility on school principals and district superintendents to secure funding from the private sector. Unfortunately, the majority of rural school districts in Indian Country do not have the operating capacity and expertise to develop complex collaborative partnerships or secure broad-based funding from non-governmental sources.

In this chapter I will examine the education technology challenges faced in Indian Country and, in particular, profile successful programs within the Cherokee Nation in Northeast Oklahoma, as well as within Bureau of Indian Affairs (BIA) funded schools in Arizona, Maine, Michigan and New Mexico. As will be seen, intermediary organizations have played a role in developing the edtech capacity of the schools and school systems in each of these communities.

AN OVERVIEW OF SCHOOL ADMINISTRATION IN INDIAN COUNTRY

It is important to note there is a critical difference between public schools operating within tribal jurisdictions and BIA-funded schools operating on tribal lands. These types of schools are very different in terms of how they are administered and funded, as well as how they access tools and resources for capacity building and professional development.

The most important distinction is that public schools, even if they are on tribal lands and serve a substantial Native American student population, are not necessarily tribally controlled schools, but may be under the direction of a larger county or town school system. Such public schools do not receive BIA funding, nor are they subject to tribal oversight or support – although tribes often do provide financial assistance to these public schools. Public schools with significant American Indian enrollments do benefit from federal funding intended to provide support for the special needs of these Indian students, such as Impact Aid and Johnson-O'Malley programs. However, public schools within the jurisdiction of the Cherokee Nation, for example, are funded and administered in much the same way as public schools in Oklahoma City. In this respect, they are largely dependent upon the state to act as an intermediary for funding, technology, capacity building and professional development.

BIA-funded schools, like public schools, serve all residents of their respective communities — Indian and non-Indian alike — however, they are subject to tribal oversight and in most cases, direct tribal administration and management. BIA-funded schools are largely dependent upon the BIA Office of Indian Education Programs (OIEP) to act as an intermediary for funding, technology, capacity building and professional development. OIEP provides educational services and funding to 185 schools and dormitories on 63 reservations located in 23 states. Of these schools, 122 are operated by tribes and local school boards through grants or contracts with the BIA. All schools are operated in accordance with the BIA's policy of local control and the federal government's policy of Indian self-determination.

CHALLENGES TO SUSTAINING EDTECH PROGRAMS

Indian Country schools face similar challenges, whether they are public schools operating within the jurisdiction of Indian Nations, or BIA-funded schools.

In general, these schools have small enrollments and limited internal resources. They are located in rural and isolated areas where information and communications technologies are not widespread — nor are they always embraced as beneficial.

Schools in these communities face particular challenges when it comes to acquiring and sustaining edtech investments:

- **Broadband Connectivity:** Sparsely populated, rural communities make broadband telecommunications services prohibitively expensive. Such high-speed connections are often unavailable without intense local planning efforts and substantial private and public investment.

- **Equipment and Software:** The high cost of purchasing, upgrading and maintaining needed hardware and software not covered by E-Rate discounts can adversely affect the implementation of many edtech activities.

- **Staff:** Poor and isolated, rural communities are unable to match salaries offered in urban and suburban areas. As a result, they have difficulty in attracting and retaining skilled teachers and network administrators. Geographic isolation also limits access to technology training opportunities — and it is often not of the highest quality even when available.

- **Operating Capacity:** State and federal funding sources support Internet connectivity and hardware purchases, and to a lesser extent, software purchases and teacher training; but these funding sources fail to provide school administrators with adequate resources for capacity building and technical assistance.

- **Corporate Partnerships:** The lack of a corporate presence in these isolated communities makes it difficult to build private sector partnerships. Building partnerships with technology corporations is often difficult because of regional limitations placed upon the philanthropic activity of many corporations. Furthermore, building partnerships requires expertise, resources, individual initiative and creative leadership — a combination that is often lacking in rural schools.

- **Funding:** The vast majority of schools in Indian Country do not operate their edtech programs from budget line items; they are also located in communities with small tax bases. Instead, they operate their programs through a patchwork of one-time monies as they become available. School systems in tribal areas often have limited ability to write effective grant proposals for private funding or develop partnerships with outside entities. The lack of local tax revenue and state funding makes it difficult for these schools to provide matching funds for various grant programs.

- **Culture:** There have been a host of challenges regarding the cultural appropriateness of information technologies and their usefulness for tribal members. These technologies were initially identified as foreign agents of assimilation

rather than useful educational or economic tools. However, tribal leaders have eased concerns by educating communities about the cultural preservation, economic development and educational opportunities information technologies afford.

Many schools and districts in Indian Country have overcome these limitations through the work of intermediary organizations including BIA and state government activism, and through active pursuit of federal grants. The following cases illustrate how.

OKLAHOMA: THE CHEROKEE NATION

With over 200,000 tribal members, the Cherokee Nation is the second largest Indian tribe in the United States. Almost 70,000 Cherokees reside in the 7,000 square mile area of the Cherokee Nation. As a federally recognized Indian tribe, the Nation has the sovereign right to exercise control over the management and development of its tribal assets, which include 66,000 acres of land and 96 miles of the Arkansas River bed. For this report, school administrators were interviewed in four Cherokee Nation schools — the Dahlonegah, Watts, Rocky Mountain and Kenwood schools, all located in Oklahoma's Adair and Delaware Counties.

Adair and Delaware are two of 14 counties located within the jurisdictional boundaries of the Cherokee Nation. Both counties are home to some of the most traditional communities within the Cherokee Nation — communities where Cherokee is a first language. Like other areas of Indian Country, cultural conservatism is a prized and protected attribute. However, both counties are also home to isolated and impoverished communities. Aside from the occasional chicken processing plants and other agricultural industries, there is limited economic activity.

In conversations with local school administrators, there was unanimous consent regarding the importance of technology and its relationship to the future success of their students. There was also agreement that sustaining edtech investments was among their top priorities. However, school administrators expressed frustration in their efforts to do so. For instance, none of their schools have line item technology budgets. Instead, they take money from a variety of other budget sources, which puts a strain on meeting these other needs. Administrators also cited lack of time, resources and in-house expertise for strategic planning, grant writing and brokering partnerships.

In spite of the difficulties, each of these schools has managed to provide and maintain T-1 Internet connectivity, as well as low students-to-computer ratios (roughly 4-1). Their capacity to integrate technology into classrooms and communities has been improved by state leadership and federal grants, but core capacity building needs required for sustaining technology investments are not being met.

ONENET

The schools of the Cherokee Nation have benefited from OneNet, an exemplary model of a state-led effort addressing the connectivity needs of small rural schools (www.onenet.net/index.htm). OneNet serves as Oklahoma's broadband telecommunications network for public schools, as well as other educational, governmental and health care institutions.

OneNet is a state-led partnership of telecommunications companies, equipment manufacturers and service providers that leverages state resources to negotiate reduced service rates. Rather than building

out an expensive public network, OneNet utilizes a number of existing private communications networks. The result is a savings of millions of dollars, as well as the rapid deployment of a high-capacity telecommunications infrastructure to rural portions of the state.

Through OneNet, schools in Adair and Delaware Counties were able to access high-speed T-1 connectivity for $400 per month. Without the support of OneNet, such broadband access would have been unlikely or cost-prohibitive — between $1,500 and $2,500 per month — given the size and budgets of these schools.

21ST CENTURY COMMUNITY LEARNING CENTERS PROGRAM

For many Cherokee communities, K-12 schools are the first community institutions to receive technology infrastructure. They become a focus for community technology access and future technology deployment. As a result, communities utilize schools as springboards for community-wide technology deployment.

In an attempt to meet this challenge, local schools have begun to tap into the U.S. Department of Education's 21st Century Community Learning Centers initiative. This program, begun in the Clinton administration, provides before- and after-school opportunities for students to receive tutoring help and other benefits. However, the program also offers significant opportunities for educational development and computer literacy training to the parents of participating students. It provides schools with the resources they need to open their computer labs to adults on specific evenings or weekends. As a result, the schools become more fully integrated into the fabric of the community. This allows adults without household IT access to engage in a structured learning environment that is tailored to meet their specific needs.

OKLAHOMA TEACHER TELEMENTORS & ITT LAB CLASSES

Local school administrators identified the lack of technology expertise among teachers as one of the key barriers to effectively integrating technology into the classroom. To assist them, the Oklahoma Department of Education offers programs to improve the technology competency of teachers at no cost to school districts. The focus of each program is to maximize the integration of technology into curriculum.

The Oklahoma Teacher Telementors Program provides peer-to-peer mentoring and technology training for teachers (www.sde.state.ok.us/home/defaultie.html). The program features over 30 mentor teachers with significant technology expertise, who provide one-on-one training tailored to the needs of teachers with limited technology skills. The mentor teachers are strategically located throughout the state, making them accessible to educators in remote schools in person, as well as by phone and e-mail.

However, the program is underutilized at local schools. One of the main reasons is that each mentor is only available for 72 hours. Once they have provided 72 hours of training, mentors are only available at a cost of $80 per hour. The limited number of mentors available in northeastern Oklahoma makes scheduling free telementor training sessions a challenging task for local schools. The overtime fees also place a hidden financial burden upon schools.

In comparison to the Telementors program, the ITT Lab Classes are teacher training workshops designed to build technology competency among teachers in three incremental stages. The first stage provides an introduction to components of the Internet and basic Internet use. The second stage provides strategies for using the Internet in the classroom with content specific

resources. Finally, teachers learn web design and basic networking. The classes are available to all teachers within the state throughout the year.

However, local school administrators interviewed for this report have expressed dissatisfaction with the way ITT Lab Classes are provided, because they fail to take into consideration the remedial computer training needs of teachers. The introductory courses are beyond the grasp of most teachers. They often return from such training classes with a higher level of frustration towards computers than they initially had and are incapable of sharing newly acquired skills with other staff. To make matters worse, lab classes are only offered in Oklahoma City, which makes it difficult for schools that happen to be a three-hour drive away.

UNMET NEEDS

Cherokee Nation schools have had difficulty utilizing relevant teacher training and technical assistance services provided by the state of Oklahoma. Clearly, the state needs to make a concerted effort to raise awareness of its training and technical assistance services among these schools. But more importantly, it needs to design and implement scalable programs that fit the needs of all schools, whether they are urban or rural. The current one-size-fits-all approach places severe burdens upon small rural schools — burdens that are detrimental over time.

Furthermore, these schools receive no support from the state of Oklahoma for key areas such as technology planning, administrative funding support, or administrative-level professional development and training. As a result, administrators don't have the budgets to hire development officers and grant writers, nor do they possess the means to attain the skills they need to secure funding from outside sources. One of the most cost-effective remedies to this problem can be realized through regional consortiums that enable schools to leverage limited resources to build their administrative capacities collectively. Unfortunately, the state of Oklahoma has yet to make this a reality.

BIA/OIEP SERVICES IN ARIZONA, MAINE, MICHIGAN AND NEW MEXICO

The BIA Office of Indian Education Programs (OIEP) provides educational services in Native American communities representing approximately 50,000 students among 238 different tribes. Their schools are small, with 60 percent of them enrolling 250 or fewer students. Because the majority of them are primary schools, most of their students continue their education at a public high school.

Originally, OIEP served more as a vehicle for implementing federal assimilation policies. In recent years, OIEP has taken an active role in raising the education standards of its schools. Since 1996, through its Access Native America initiative, OIEP has become the main driving force for deploying telecommunications infrastructure and implementing edtech programs throughout Indian Country. In five years, the initiative wired all 185 BIA-funded K-12 schools with Internet connectivity ranging from basic dial-up to broadband. OIEP, remarkably, achieved this task without a line item budget. Much like the public schools of the Cherokee Nation, OIEP has to be very creative in juggling its budget to fund technology, especially since their schools have received minimal E-Rate support. Therefore, much of OIEP's success — and the success of their individual schools — relied on a number of partnerships among the private, public and philanthropic sectors.

To learn more about edtech activities within BIA-funded schools, administrators were

interviewed at Indian Island School of the Penobscot Indian Nation in Maine; Gila Crossing Community School of the Gila River Indian Community in Arizona; Hannahville Indian School of the Hannahville Indian Community in Michigan; and Laguna Middle School of the Laguna Nation Pueblo in New Mexico.

MEETING THE CHALLENGES

Similar to schools within the Cherokee Nation, the BIA-funded school administrators unanimously stressed the importance of technology and its relationship to the future success of their students. Likewise, there was unanimous consent that sustaining edtech investments was a priority. However, they did not express the same level of frustration regarding their attempts to do so. These administrators are not struggling as intensely to climb the technology learning curve, largely because they have been able to collaborate with other schools and outside partners to address their needs.

OIEP's training and professional development programs have instituted collaborative processes for addressing technical assistance, teacher training, professional development and capacity building needs. The most important result of these processes is that the schools now have a better understanding of how to build and maintain effective, mutually beneficial partnerships.

ACCESS NATIVE AMERICA

The Access Native America initiative exemplifies how OIEP is capable of acting as an intermediary on behalf of BIA-funded schools by leveraging resources and purchasing power to provide services that would otherwise be unavailable (www.oiep.bia.edu). The initiative was chartered by the U.S. Secretary of the Interior to ensure that schools funded by the BIA met former President Clinton's challenge to wire every classroom in America by the year 2000. The project forged a number of key partnerships with the U.S. Geological Survey, which provided engineering and networking expertise, as well as with Microsoft, Intel and the Universities of Texas and Kansas. The project brought online all of its 185 elementary and secondary schools by 2001, just one year behind schedule. Given the huge task of providing connectivity to 185 of the most remote and isolated schools in the United States, Access Native America has proven to be one of the true success stories of the OIEP.

Now that each school has connectivity, OIEP submits an application for E-Rate discounts to pay the monthly Internet fees for its 185 schools. In doing so, OIEP leverages its resources for the benefit of the schools it serves. Therefore, one of the largest hurdles that BIA-funded schools faced — providing and maintaining Internet connectivity — has been overcome by OIEP.

THE FOUR DIRECTIONS PROJECT

From 1995 to 2000, the Four Directions Project (4D) served as a highly successful collaboration (www.4directions.org/index.html) that involved the Tribal Nations, federal government agencies, universities, academic organizations and private corporations. Coordinated by the Pueblo of Laguna Department of Education and funded by a Technology Challenge Grant from the U.S. Department of Education and corporate donations, the 4D project improved the edtech capacities of 19 BIA-funded schools. It also provided them with the tools, resources and expertise they needed to incorporate technology into classrooms in a culturally appropriate manner.

Each participating school had a 4D facilitation team composed of teachers, students, administrators, school board members, community members and parents. These teams went through rigorous annual training workshops to increase the level of practical

knowledge necessary to create culturally appropriate digital content and integrate it into the classroom. Students and teachers learned how to work as teams, both in person and over the Internet.

The 4D project had a lasting impact on participating schools in the sense that they developed the organizational capacity to utilize technology effectively and sustain their endeavors through partnerships. Furthermore, 4D brought national attention to these schools — and in doing so, opened new opportunities for attracting private funding and additional partnerships, enabling them to continue their innovative work.

Unfortunately, only a small number of BIA-funded schools had the opportunity to participate in the 4D project. The vast majority of BIA-funded schools have yet to partake in a comprehensive collaborative project, nor have they built up their administrative and technological capacities. Clearly there is a need for OIEP to replicate successful models like 4D and expand opportunities made available through such projects to all BIA-funded schools.

CENTER FOR EDUCATIONAL TECHNOLOGY IN INDIAN AMERICA (CETIA)

The Center for Educational Technology in Indian America (CETIA) is headquartered at the Pueblo of Laguna Nation, operated by the Pueblo's Department of Education. CETIA is attempting to build on the success of the 4D project by serving as a hub for incubating collaborative tribal, federal and private partnerships (www.ldoe.org/cetia/index.htm).

CETIA provides educators and administrators with training in edtech curriculum development. CETIA staff and regional experts also assist schools with technology planning, professional development, hardware/software, Internet connectivity and tech support. CETIA also facilitates research regarding the use of technology as a means of supporting culturally relevant learning and cultural preservation.

In the summers of 2001 and 2002, CETIA provided BIA-funded schools with Intel Teach to the Future classes. The goal of this program is to train teachers to promote project-based learning and effectively integrate computers into their existing curriculum to increase student achievement. Over 54 master teachers from 46 Indian schools nationwide have participated in these classes.

In addition to this program, one of the more exciting developments to emerge from CETIA is the Digital Council Fires project, a collaboration of CETIA, OIEP and Lightspan (www.ldoe.org/cetia/lightspan.htm). The project utilizes a Lightspan Network website that is designed for Indian educators, students and schools. The site provides a number of useful teaching and learning resources, as well as culturally-relevant content to schools on a subscription basis. To support the effective use of web-based curriculum, training provided by Lightspan is available throughout the year in a number of locations across Indian Country.

CETIA has already provided services to more schools than the 4D project. But its long-term success will depend upon its ability to assist all 185 BIA-funded schools. Fortunately, efforts to fund the expansion of services, like those provided by CETIA, led to the creation of the Indian Education Foundation. Established through legislation at the end of the Clinton administration, the young foundation will hopefully have the capacity to provide CETIA with the resources it needs to expand its services to all BIA-funded schools. Unfortunately, the Department of Interior, which houses the BIA, has been slow in developing the foundation. As a result, the potential of the Indian Education Foundation has yet to be realized.

CONCLUSION

Schools with sufficient capacity are capable of effective planning and grant writing. They are capable of building private sector partnerships and working effectively with intermediaries. And they are capable of finding ways to leverage resources and attracting a talented, well-trained staff. Each of these activities is essential to sustaining technology investments. Therefore, building capacity in the schools of Indian Country is essential.

There are still a number of opportunities in which these schools can build their operating capacities. The majority of these opportunities are dependent upon the initiative and individual leadership of school superintendents and principals. Yet the inability — or sometimes unwillingness — of these schools to collaborate limits their ability to build capacity, attract partnerships and secure funding for large, multi-year projects.

For the BIA-funded schools, collaboration has been the key to their success in implementing innovative and culturally relevant edtech programs, providing low-cost teacher training and professional development and building sufficient organizational capacity to sustain these endeavors. OIEP has played a significant role in institutionalizing these collaborative processes; as a result, collaboration among these schools has allowed them to build upon the successes of previous efforts.

Unfortunately, the majority of BIA-funded schools have yet to participate in far-reaching collaborative projects. As a result, they have yet to build organizational and technology capacities in a similar manner. CETIA is attempting to bridge this gap by expanding to a larger number of schools, but it lacks the resources needed to reach the majority of BIA-funded schools. The creation of the Indian Education Foundation provides hope that additional resources will eventually become available. However, the Department of Interior has not shown a sincere commitment to developing the Indian Education Foundation to its potential. Nor has the current administration provided the leadership necessary to ensure that the Indian Education Foundation becomes operational and adequately funded. Ultimately, this lack of commitment and action impedes the growth of the foundation, limiting potentially valuable edtech opportunities for the majority of BIA-funded schools.

Kade Twist is a telecommunications consultant based in Phoenix, Az.

PART D—ENHANCING EDUCATION THROUGH TECHNOLOGY

SEC. 2401. SHORT TITLE.

This part may be cited as the 'Enhancing Education Through Technology Act of 2001'.

SEC. 2402. PURPOSES AND GOALS.

a. PURPOSES- The purposes of this part are the following:

(1) To provide assistance to States and localities for the implementation and support of a comprehensive system that effectively uses technology in elementary schools and secondary schools to improve student academic achievement.

(2) To encourage the establishment or expansion of initiatives, including initiatives involving public-private partnerships, designed to increase access to technology, particularly in schools served by high-need local educational agencies.

(3) To assist States and localities in the acquisition, development, interconnection, implementation, improvement, and maintenance of an effective educational technology infrastructure in a manner that expands access to technology for students (particularly for disadvantaged students) and teachers.

(4) To promote initiatives that provide school teachers, principals, and administrators with the capacity to integrate technology effectively into curricula and instruction that are aligned with challenging State academic content and student academic achievement standards, through such means as high-quality professional development programs.

(5) To enhance the ongoing professional development of teachers, principals, and administrators by providing constant access to training and updated research in teaching and learning through electronic means.

(6) To support the development and utilization of electronic networks and other innovative methods, such as distance learning, of delivering specialized or rigorous academic courses and curricula for students in areas that would not otherwise have access to such courses and curricula, particularly in geographically isolated regions.

(7) To support the rigorous evaluation of programs funded under this part, particularly regarding the impact of such programs on student academic achievement, and ensure that timely information on the results of such evaluations is widely accessible through electronic means.

(8) To support local efforts using technology to promote parent and family involvement in education and communication among students, parents, teachers, principals, and administrators.

b. GOALS-

(1) PRIMARY GOAL- The primary goal of this part is to improve student academic achievement through the use of technology in elementary schools and secondary schools.

(2) ADDITIONAL GOALS- The additional goals of this part are the following:

(A) To assist every student in crossing the digital divide by ensuring that every student is technologically literate by the time the student finishes the eighth grade, regardless of the student's race, ethnicity, gender, family income, geographic location, or disability.

(B) To encourage the effective integration of technology resources and systems with teacher training and curriculum development to establish research-based

instructional methods that can be widely implemented as best practices by State educational agencies and local educational agencies.

SEC. 2403. DEFINITIONS.

In this part:

(1) ELIGIBLE LOCAL ENTITY- The term eligible local entity' means —
  (A) a high-need local educational agency; or
  (B) an eligible local partnership.

(2) ELIGIBLE LOCAL PARTNERSHIP- The term eligible local partnership' means a partnership that —
  (A) shall include at least one high-need local educational agency and at least one —
    (i) local educational agency that can demonstrate that teachers in schools served by the agency are effectively integrating technology and proven teaching practices into instruction, based on a review of relevant research, and that the integration results in improvement in —
      (I) classroom instruction in the core academic subjects; and
      (II) the preparation of students to meet challenging State academic content and student academic achievement standards;
    (ii) institution of higher education that is in full compliance with the reporting requirements of section 207(f) of the Higher Education Act of 1965 and that has not been identified by its State as low-performing under section 208 of such Act;
    (iii) for-profit business or organization that develops, designs, manufactures, or produces technology products or services, or has substantial expertise in the application of technology in instruction; or
    (iv) public or private nonprofit organization with demonstrated experience in the application of educational technology to instruction; and
  (B) may include other local educational agencies, educational service agencies, libraries, or other educational entities appropriate to provide local programs.

(3) HIGH-NEED LOCAL EDUCATIONAL AGENCY- The term high-need local educational agency' means a local educational agency that —
  (A) is among the local educational agencies in a State with the highest numbers or percentages of children from families with incomes below the poverty line; and
  (B) (i) operates one or more schools identified under section 1116; or
    (ii) has a substantial need for assistance in acquiring and using technology.

SEC. 2404. AUTHORIZATION OF APPROPRIATIONS.

a. IN GENERAL- There are authorized to be appropriated to carry out subparts 1 and 2, $1,000,000,000 for fiscal year 2002, and such sums as may be necessary for each of the 5 succeeding fiscal years.

b. ALLOCATION OF FUNDS BETWEEN STATE AND LOCAL AND NATIONAL

SEC. 2411. ALLOTMENT AND REALLOTMENT.

a. RESERVATIONS AND ALLOTMENT- From the amount made available to carry out this subpart under section 2404(b)(1) for a fiscal year—

(1) The Secretary shall reserve—

(A) three-fourths of 1 percent for the Secretary of the Interior for programs under this subpart for schools operated or funded by the Bureau of Indian Affairs;

(B) one-half of 1 percent to provide assistance under this subpart to the outlying areas; and

(C) such sums as may be necessary for continuation awards on grants awarded under section 3136 prior to the date of enactment of the No Child Left Behind Act of 2001; and

(2) From the remainder of such amount and subject to subsection (b), the Secretary shall make grants by allotting to each eligible State educational agency under this subpart an amount that bears the same relationship to such remainder for such year as the amount received under part A of title I for such year by such State educational agency bears to the amount received under such part for such year by all State educational agencies.

b. MINIMUM ALLOTMENT- The amount of any State educational agency's allotment under subsection (a)(2) for any fiscal year may not be less than one-half of 1 percent of the amount made available for allotments to States under this part for such year.

c. REALLOTMENT OF UNUSED FUNDS- If any State educational agency does not apply for an allotment under this subpart for a fiscal year, or does not use its entire allotment under this subpart for that fiscal year, the Secretary shall reallot the amount of the State educational agency's allotment, or the unused portion of the allotment, to the remaining State educational agencies that use their entire allotments under this subpart in accordance with this section.

d. STATE EDUCATIONAL AGENCY DEFINED- In this section, the term State educational agency' does not include an agency of an outlying area or the Bureau of Indian Affairs.

SEC. 2412. USE OF ALLOTMENT BY STATE.

a. IN GENERAL- Of the amount provided to a State educational agency (from the agency's allotment under section 2411(a)(2)) for a fiscal year—

(1) The State educational agency may use not more than 5 percent to carry out activities under section 2415; and

(2) The State educational agency shall distribute the remainder as follows:

(A) from 50 percent of the remainder, the State educational agency shall award subgrants by allocating to each eligible local educational agency that has submitted an application to the State educational agency under section 2414, for the activities described in section 2416, an amount that bears the same relationship to 50 percent of the remainder for such year as the amount received under part A of title I for such year by such local educational agency bears to the amount received under such part for such year by all local educational agencies within the State.

(B) from 50 percent of the remainder and subject to subsection (b), the State educational agency shall award subgrants, through a State-determined competitive process, to eligible local entities that have submitted applications to the State educational agency under section 2414, for the activities described in section 2416.

b. SUFFICIENT AMOUNTS-

(1) SPECIAL RULE- In awarding a subgrant under subsection (a)(2)(B), the State educational agency shall—

(A) determine the local educational agencies that—

(i) received allocations under subsection (a)(2)(A) that are not of sufficient size to be effective, consistent with the purposes of this part; and

(ii) are eligible local entities;

(B) give priority to applications submitted by eligible local educational agencies described in subparagraph (A); and

(C) determine the minimum amount for awards under subsection (a)(2)(B) to ensure that subgrants awarded under that subsection are of sufficient size to be effective.

(2) SUFFICIENCY- In awarding subgrants under subsection (a)(2)(B), each State educational agency shall ensure that each subgrant is of sufficient size and duration, and that the program funded by the subgrant is of sufficient scope and quality, to carry out the purposes of this part effectively.

(3) DISTRIBUTION- In awarding subgrants under subsection (a)(2)(B), each State educational agency shall ensure an equitable distribution of assistance under this subpart among urban and rural areas of the State, according to the demonstrated need of those local educational agencies serving the areas.

c. FISCAL AGENT- If an eligible local partnership receives a subgrant under subsection (a)(2)(B), a local educational agency in the partnership shall serve as the fiscal agent for the partnership.

d. ASSISTANCE- Each State educational agency receiving a grant under section 2411(a) shall—

(1) Identify the local educational agencies served by the State educational agency that—

(A) have the highest numbers or percentages of children from families with incomes below the poverty line; and

(B) demonstrate to such State educational agency the greatest need for technical assistance in developing an application under section 2414; and

(2) Offer the technical assistance described in paragraph (1)(B) to those local educational agencies.

SEC. 2413. STATE APPLICATIONS.

a. IN GENERAL- To be eligible to receive a grant under this subpart, a State educational agency shall submit to the Secretary, at such time and in such manner as the Secretary may specify, an application containing a new or updated statewide long-range strategic educational technology plan (which shall address the educational technology needs of local educational agencies) and such other information as the Secretary may reasonably require.

b. CONTENTS- Each State application submitted under subsection (a) shall include each of the following:

(1) An outline of the State educational agency's long-term strategies for improving student academic achievement, including technology literacy, through the effective use of technology in classrooms throughout the State, including improving the capacity of teachers to integrate technology effectively into curricula and instruction.

(2) A description of the State educational agency's goals for using advanced technology to improve student academic achievement, and how those goals are aligned with challenging State academic content and student academic achievement standards.

(3) A description of how the State educational agency will take steps to ensure that all students and teachers in the State, particularly students and teachers in districts served by high-need local educational agencies, have increased access to technology.

(4) A description of the process and accountability measures that the State educational agency will use to evaluate the extent to which activities funded under this subpart are effective in integrating technology into curricula and instruction.

(5) A description of how the State educational agency will encourage the development and utilization of innovative strategies for the delivery of specialized or rigorous academic courses and curricula through the use of technology, including distance learning technologies, particularly for those areas of the State that would not otherwise have access to such courses and curricula due to geographical isolation or insufficient resources.

(6) An assurance that financial assistance provided under this subpart will supplement, and not supplant, State and local funds.

(7) A description of how the plan incorporates teacher education, professional development, and curriculum development, and how the State educational agency will work to ensure that teachers and principals in a State receiving funds under this part are technologically literate.

(8) A description of—

(A) how the State educational agency will provide technical assistance to applicants under section 2414, especially to those applicants serving the highest numbers or percentages of children in poverty or with the greatest need for technical assistance; and

(B) the capacity of the State educational agency to provide such assistance.

(9) A description of technology resources and systems that the State will provide for the purpose of establishing best practices that can be widely replicated by State educational agencies and local educational agencies in the State and in other States.

(10) A description of the State's long-term strategies for financing technology to ensure that all students, teachers, and classrooms have access to technology.

(11) A description of the State's strategies for using technology to increase parental involvement.

(12) A description of how the State educational agency will ensure that each sub-grant awarded under section 2412(a)(2)(B) is of sufficient size and duration, and that the program funded by the subgrant is of sufficient scope and quality, to carry out the purposes of this part effectively.

(13) A description of how the State educational agency will ensure ongoing integration of technology into school curricula and instructional strategies in all schools in the State, so that technology will be fully integrated into the curricula and instruction of the schools by December 31, 2006.

(14) A description of how the local educational agencies in the State will provide incentives to teachers who are technologically literate and teaching in rural or urban areas, to encourage such teachers to remain in those areas.

(15) A description of how public and private entities will participate in the implementation and support of the plan.

c. DEEMED APPROVAL- An application submitted by a State educational agency pursuant to subsection (a) shall be deemed to be approved by the Secretary unless the Secretary makes a written determination, prior to the expiration of the 120-day period beginning on the date on which the Secretary received the application, that the application is not in compliance with this part.

d. DISAPPROVAL- The Secretary shall not finally disapprove the application, except after giving the State educational agency notice and an opportunity for a hearing.

e. NOTIFICATION- If the Secretary finds that the application is not in compliance, in whole or in part, with this part, the Secretary shall—

(1) Give the State educational agency notice and an opportunity for a hearing; and

(2) Notify the State educational agency of the finding of noncompliance and, in such notification, shall—

(A) cite the specific provisions in the application that are not in compliance; and

(B) request additional information, only as to the noncompliant provisions, needed to make the application compliant.

f. RESPONSE- If the State educational agency responds to the Secretary's notification described in subsection (e)(2) during the 45-day period beginning on the date on which the agency received the notification, and resubmits the application with the requested information described in subsection (e)(2)(B), the Secretary shall approve or disapprove such application prior to the later of—

(1) The expiration of the 45-day period beginning on the date on which the application is resubmitted; or

(2) The expiration of the 120-day period described in subsection (c).

g. FAILURE TO RESPOND- If the State educational agency does not respond to the Secretary's notification described in subsection (e)(2) during the 45-day period beginning on the date on which the agency received the notification, such application shall be deemed to be disapproved.

SEC. 2414. LOCAL APPLICATIONS.

a. IN GENERAL- To be eligible to receive a subgrant from a State educational agency under this subpart, a local educational agency or eligible local entity shall submit to the State educational agency an application containing a new or updated local long-range strategic educational technology plan that is consistent with the objectives of the statewide educational technology plan described in section 2413(a), and such other information as the State educational agency may reasonably require, at such time and in such manner as the State educational agency may require.

b. CONTENTS- The application shall include each of the following:

(1) A description of how the applicant will use Federal funds under this subpart to improve the student academic achievement, including technology literacy, of all students attending schools served by the local educational agency and to improve the capacity of all teachers teaching in schools served by the local educational agency to integrate technology effectively into curricula and instruction.

(2) A description of the applicant's specific goals for using advanced technology to improve student academic achievement, aligned with challenging State academic content and student academic achievement standards.

(3) A description of the steps the applicant will take to ensure that all students and teachers in schools served by the local educational agency involved have

increased access to educational technology, including how the agency would use funds under this subpart (such as combining the funds with funds from other sources), to help ensure that—

(A) students in high-poverty and high-needs schools, or schools identified under section 1116, have access to technology; and

(B) teachers are prepared to integrate technology effectively into curricula and instruction.

(4) A description of how the applicant will—

(A) identify and promote curricula and teaching strategies that integrate technology effectively into curricula and instruction, based on a review of relevent research, leading to improvements in student academic achievement, as measured by challenging State academic content and student academic achievement standards; and

(B) provide ongoing, sustained professional development for teachers, principals, administrators, and school library media personnel serving the local educational agency, to further the effective use of technology in the classroom or library media center, including, if applicable, a list of the entities that will be partners with the local educational agency involved in providing the ongoing, sustained professional development.

(5) A description of the type and costs of technologies to be acquired under this subpart, including services, software, and digital curricula, and including specific provisions for interoperability among components of such technologies.

(6) A description of how the applicant will coordinate activities carried out with funds provided under this subpart with technology-related activities carried out with funds available from other Federal, State, and local sources.

(7) A description of how the applicant will integrate technology (including software and other electronically delivered learning materials) into curricula and instruction, and a timeline for such integration.

(8) A description of how the applicant will encourage the development and utilization of innovative strategies for the delivery of specialized or rigorous academic courses and curricula through the use of technology, including distance learning technologies, particularly for those areas that would not otherwise have access to such courses and curricula due to geographical isolation or insufficient resources.

(9) A description of how the applicant will ensure the effective use of technology to promote parental involvement and increase communication with parents, including a description of how parents will be informed of the technology being applied in their child's education so that the parents are able to reinforce at home the instruction their child receives at school.

(10) A description of how programs will be developed, where applicable, in collaboration with adult literacy service providers, to maximize the use of technology.

(11) A description of the process and accountability measures that the applicant will use to evaluate the extent to which activities funded under this subpart are effective in integrating technology into curricula and instruction, increasing the ability of teachers to teach, and enabling students to meet challenging State academic content and student academic achievement standards.

(12) A description of the supporting resources (such as services, software, other electronically delivered learning materials, and print resources) that will be acquired to ensure successful and effective uses of technology.

c. COMBINED APPLICATIONS- A local educational agency that is an eligible local entity and submits an application to the State educational agency under this section for funds awarded under section 2412(a)(2)(A) may combine the agency's application for funds awarded under that section with an application for funds awarded under section 2412(a)(2)(B).

d. SPECIAL RULE-

(1) CONSORTIUM APPLICATIONS-

(A) IN GENERAL- For any fiscal year, a local educational agency applying for financial assistance described in section 2412(a)(2)(A) may apply as part of a consortium that includes other local educational agencies, institutions of higher education, educational service agencies, libraries, or other educational entities appropriate to provide local programs.

(B) FISCAL AGENT- If a local educational agency applies for and receives financial assistance described in section 2412(a)(2)(A) as part of a consortium, the local educational agency shall serve as the fiscal agent for the consortium.

(2) STATE EDUCATIONAL AGENCY ASSISTANCE- At the request of a local educational agency, a State educational agency may assist the local educational agency in the formation of a consortium described in paragraph (1) to provide services for the teachers and students served by the local educational agency.

SEC. 2415. STATE ACTIVITIES.

From funds made available under section 2412(a)(1), a State educational agency shall carry out activities and assist local efforts to carry out the purposes of this part, which may include the following activities:

(1) Developing, or assisting applicants or recipients of funds under this subpart in the development and utilization of, innovative strategies for the delivery of specialized or rigorous academic courses and curricula through the use of technology, including distance learning technologies, and providing other technical assistance to such applicants or recipients throughout the State, with priority given to high-need local educational agencies.

(2) Establishing or supporting public-private initiatives (such as interest-free or reduced-cost loans) for the acquisition of educational technology for high-need local educational agencies and students attending schools served by such agencies.

(3) Assisting recipients of funds under this subpart in providing sustained and intensive, high-quality professional development based on a review of relevant research in the integration of advanced technologies, including emerging technologies, into curricula and instruction and in using those technologies to create new learning environments, including training in the use of technology to —

(A) access data and resources to develop curricula and instructional materials;

(B) enable teachers —

(i) to use the Internet and other technology to communicate with parents, other teachers, principals, and administrators; and

(ii) to retrieve Internet-based learning resources; and

(C) lead to improvements in classroom instruction in the core academic subjects, that effectively prepare students to meet challenging State academic content standards and student academic achievement standards.

(4) Assisting recipients of funds under this subpart in providing all students (including students with disabilities and students with limited English proficiency) and teachers with access to educational technology.

(5) Developing performance measurement systems to determine the effectiveness of educational technology programs funded under this subpart, particularly in determining the extent to which activities funded under this subpart are effective in integrating technology into curricula and instruction, increasing the ability of teachers to teach, and enabling students to meet challenging State academic content and student academic achievement standards.

(6) Collaborating with other State educational agencies on distance learning, including making specialized or rigorous academic courses and curricula available to students in areas that would not otherwise have access to such courses and curricula.

SEC. 2416. LOCAL ACTIVITIES.

a. PROFESSIONAL DEVELOPMENT-

(1) IN GENERAL- A recipient of funds made available under section 2412(a)(2) shall use not less than 25 percent of such funds to provide ongoing, sustained, and intensive, high-quality professional development. The recipient shall provide professional development in the integration of advanced technologies, including emerging technologies, into curricula and instruction and in using those technologies to create new learning environments, such as professional development in the use of technology—

(A) to access data and resources to develop curricula and instructional materials;

(B) to enable teachers—

(i) to use the Internet and other technology to communicate with parents, other teachers, principals, and administrators; and

(ii) to retrieve Internet-based learning resources; and

(C) to lead to improvements in classroom instruction in the core academic subjects, that effectively prepare students to meet challenging State academic content standards, including increasing student technology literacy, and student academic achievement standards.

(2) WAIVERS- Paragraph (1) shall not apply to a recipient of funds made available under section 2412(a)(2) that demonstrates, to the satisfaction of the State educational agency involved, that the recipient already provides ongoing, sustained, and intensive, high-quality professional development that is based on a review of relevant research, to all teachers in core academic subjects in the integration of advanced technologies, including emerging technologies, into curricula and instruction.

b. OTHER ACTIVITIES- In addition to the activities described in subsection (a), a recipient of funds made available by a State educational agency under section 2412(a)(2) shall use such funds to carry out other activities consistent with this subpart, which may include the following:

(1) Establishing or expanding initiatives, particularly initiatives involving public-private partnerships, designed to increase access to technology for students and teachers, with special emphasis on the access of high-need schools to technology.

(2) Adapting or expanding existing and new applications of technology to enable teachers to increase student academic achievement, including technology literacy—

(A) through the use of teaching practices that are based on a review of relevant research and are designed to prepare students to meet challenging State academic content and student academic achievement standards; and

(B) by the development and utilization of innovative distance learning strategies to deliver specialized or rigorous academic courses and curricula to areas that would not otherwise have access to such courses and curricula.

(3) Acquiring proven and effective courses and curricula that include integrated technology and are designed to help students meet challenging State academic content and student academic achievement standards.

(4) Utilizing technology to develop or expand efforts to connect schools and teachers with parents and students to promote meaningful parental involvement, to foster increased communication about curricula, assignments, and assessments between students, parents, and teachers, and to assist parents to understand the technology being applied in their child's education, so that parents are able to reinforce at home the instruction their child receives at school.

(5) Preparing one or more teachers in elementary schools and secondary schools as technology leaders who are provided with the means to serve as experts and train other teachers in the effective use of technology, and providing bonus payments to the technology leaders.

(6) Acquiring, adapting, expanding, implementing, repairing, and maintaining existing and new applications of technology, to support the school reform effort and to improve student academic achievement, including technology literacy.

(7) Acquiring connectivity linkages, resources, and services (including the acquisition of hardware and software and other electronically delivered learning materials) for use by teachers, students, academic counselors, and school library media personnel in the classroom, in academic and college counseling centers, or in school library media centers, in order to improve student academic achievement.

(8) Using technology to collect, manage, and analyze data to inform and enhance teaching and school improvement efforts.

(9) Implementing performance measurement systems to determine the effectiveness of education technology programs funded under this subpart, particularly in determining the extent to which activities funded under this subpart are effective in integrating technology into curricula and instruction, increasing the ability of teachers to teach, and enabling students to meet challenging State academic content and student academic achievement standards.

(10) Developing, enhancing, or implementing information technology courses.

Subpart 2 — National Technology Activities

SEC. 2421. NATIONAL ACTIVITIES.

a. STUDY- Using funds made available under section 2404(b)(2), the Secretary —

(1) Shall conduct an independent, long-term study, utilizing scientifically-based research methods and control groups or control conditions —

(A) on the conditions and practices under which educational technology is effective in increasing student academic achievement; and

(B) on the conditions and practices that increase the ability of teachers to integrate technology effectively into curricula and instruction, that enhance the learning environment and opportunities, and that increase student academic achievement, including technology literacy;

(2) Shall establish an independent review panel to advise the Secretary on methodological and other issues that arise in conducting the long-term study;

(3) Shall consult with other interested Federal departments or agencies, State and local educational practitioners and policymakers (including teachers, principals, and superintendents), and experts in technology, regarding the study; and

(4) Shall submit to Congress interim reports, when appropriate, and a final report, to be submitted not later than April 1, 2006, on the findings of the study.

b. DISSEMINATION- Using funds made available under section 2404(b)(2), the Secretary shall make widely available, including through dissemination on the Internet and to all State educational agencies and other recipients of funds under this part, findings identified through activities carried out under this section regarding the conditions and practices under which educational technology is effective in increasing student academic achievement.

c. TECHNICAL ASSISTANCE- Using funds made available under section 2404(b)(2), the Secretary may provide technical assistance (directly or through the competitive award of grants or contracts) to State educational agencies, local educational agencies, and other recipients of funds, particularly in rural areas, under this part, in order to assist such State educational agencies, local educational agencies, and other recipients to achieve the purposes of this part.

SEC. 2422. NATIONAL EDUCATION TECHNOLOGY PLAN.

a. IN GENERAL- Based on the Nation's progress and an assessment by the Secretary of the continuing and future needs of the Nation's schools in effectively using technology to provide all students the opportunity to meet challenging State academic content and student academic achievement standards, the Secretary shall update and publish, in a form readily accessible to the public, a national long-range technology plan, by not later than 12 months after the date of enactment of the No Child Left Behind Act of 2001.

b. CONTENTS- The plan referred to in subsection (a) shall include each of the following:

(1) A description of the manner in which the Secretary will promote —

(A) higher student academic achievement through the integration of advanced technologies, including emerging technologies, into curricula and instruction;

(B) increased access to technology for teaching and learning for schools with a high number or percentage of children from families with incomes below the poverty line; and

(C) the use of technology to assist in the implementation of State systemic reform strategies.

(2) A description of joint activities of the Department of Education and other Federal departments or agencies that will promote the use of technology in education.

APPENDIX B

What Is Your School District's Total Cost of Ownership Type?

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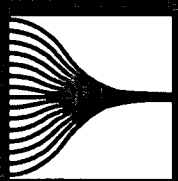
	The "TCO-Savvy"District	The "Doing the Best We Can" District	The "Worry About it Tomorrow" District
Professional Development	Devotes 15-30% of its budget to staff development	Provides some staff training, but not at times that are convenient or when staff is ready to put the lessons to work	Assumes that teachers and staff "will learn on the job"
Support	Provides computer support at a ratio of at least one support person for every 50 to 70 computers or one person for every 500 computers in a closely managed networked environment	Relies on a patchwork of teachers, students and overworked district staff to maintain network and fix problems. Does not track the amount of time its network is down or computers are not in use	Relies on the "hey Joe" sort of informal support
Software	Recognizes that the greater diversity of software packages and operating systems, the more the support that will be required. Makes provisions for regular upgrading of software packages	Utilizes centralized software purchasing, but choice of application and respective support left to individual schools and/or staff members	Expects support personnel to manage whatever software happens to be installed on a district computer
Replacement Costs	Budgets to replace computers on a regular schedule, usually every five years, whether leased or purchased	Plans to replace computers when they no longer can be repaired	Assumes that when computers are purchased with 20-year bonds that they will last forever



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