The world is changing. Students are changing. Schools and classrooms are changing, too, but not quickly enough.

This is hardly news. Numerous documents have underscored education’s essential role in sustaining a vital democracy and economy. They bemoan the fact that the performance of many American students lags behind their peers from other countries. And many critics, given what’s at stake, do not hesitate to assign blame for the current situation.

This paper takes a different approach.

While acknowledging the legitimacy of these concerns, it aspires to catalyze a deeper conversation grounded on two assumptions: 1) that learning and teaching must transform and 2) that technology can accelerate the transformation. The reason is evident: the practice of learning and the application of technology are intrinsically exciting, engaging endeavors. Consequently, it is time to imbue both with a shared purpose in redesigning the education system.

What would such transformation look like? Part One of this paper offers a plausible response. It tells the story of “Central School District.” CSD could be located anywhere; the actions described in the scenario are relevant everywhere. Part Two highlights five underlying drivers of change—involving students, teachers, funding, policy, and technology—that propel the scenario forward. Collectively, they describe the challenges and opportunities facing all school districts. The paper then shifts from a discussion of the “whats” (the scenario) and the “whys” (the underlying drivers) into action mode by identifying the “whos” and the “hows” in Part Three, which introduces the Connected Classroom. Based on more than 25 years of listening to and serving educators’ needs, it is Dell’s contribution, supported by Intel and aimed at transforming learning and teaching through the thoughtful use of technology.

Embedded throughout the paper is an open invitation to educators.

Dell and Intel want to join you in catalyzing a new conversation about learning, technology, and the future—one that embraces multiple insights, shares a common commitment to transformation, and results, ultimately, in decisive action.
PART ONE

Ancient Alex Goes Digital: A Scenario Where Education Encounters and Embraces 21st Century Learning

“I was wondering what Ancient Alex would have thought about the Internet,” replied Casey James. It was after dinner and her older brother Logan had just asked Casey what she was doing.

“Ancient Alex” was Casey’s pet name for Alexander the Great. For the past five weeks, student teams from Casey’s fifth grade social studies/technology class had been studying different civilizations. Next month, the class would be presenting their projects to the board of education.

The idea came to Logan on his way to high school the next morning. Mr. Evans was getting ready for his first class of the day when Logan burst through the door. “Can I ask you something, Mr. Evans?” Logan shouted excitedly, as he began to explain.

It turned out that Nathan Evans loved Logan’s idea. And the 12th grade computer science teacher knew exactly what to do about it...

Five Years Earlier: A School System at the Crossroads

Central School District, like communities nationwide, was feeling pressure from many quarters. The district had to meet state academic standards that still fell short of articulating what students in the 21st century needed to know and be able to do. The political environment only complicated the situation, as competing community interests butted heads over ideological or control issues marginally related to student interests.

CSD had also been losing too many students, but not because of dire socio-economic conditions. In fact, the district had raised its graduation rate and was sending more students on to college. No, the threat was less about dropping out, than dropping in. Students were coming to school, but disengaging once there, the experience too removed from the rest of their digitally networked world. Most adults were unaware of the consequences, having themselves attended school during an earlier analog era.

The superintendent and school board asked the community to participate in crafting a new vision for the district. Parents, community leaders, and taxpayers joined students, school employees and district leaders in exploring the implications of emerging education, demographic, socio-economic, and cultural trends. The outreach strategy paid off. Not only did CSD leaders raise public awareness of the need to change. They also convinced community members to invest in making the change possible.
The Key Focus: Instruction

The community vision, coupled with local revenues and federal funds, enabled CSD leaders to roll out a comprehensive technology plan. To enrich instruction, they provided each teacher with a computer, each school with a mobile computer lab, and each classroom with interactive technologies, such as a digital whiteboard or projector. Teachers then volunteered to participate in pilot programs that enhanced collaboration across different subject areas and grade levels. The pilots also provided younger kids with computer netbooks and older students with notebooks or laptops, toward the goal of providing 1:1 computers in all classrooms.

To focus district efforts on increasing student performance—a critical community goal—CSD leaders took three key steps. First, they invested in licensing a digital learning management system in order to align instructional content with state and district expectations. Several years later, CSD purchased software that mapped core subject areas, higher order thinking skills, and individual learning styles to state standards. And they put the district curriculum and a wealth of instructional materials online.

Second, CSD leaders focused on professional support and communications. They hired school technology specialists, many of whom were former teachers, to help teachers integrate new technology into their professional learning plans. They gave each teacher web space to post homework assignments, grades, and other useful information for parents and students. Students at home temporarily due to illness, suspension, or bad weather could now stay current with their classes. And CPS leaders displayed timely information on the district website to keep the community informed and involved.

Third, the district worked closely with its key technology provider to insure consistent implementation. Together, they increased the district’s data storage capacity to support reliable and expanded use of the technology over time and address security issues. The partners also worked out a pay-as-you-go plan consistent with short-term and unpredictable district budget cycles.

As a result, by mid-2010, a visitor to Central School District could witness the following activities during a normal school day:

- Kindergarteners learning together how to add and subtract their numbers while gathered attentively on the floor in front of an interactive white board.

- First graders honing their writing skills and gaining an early sense of themselves in the world by sharing ideas with classmates, teachers, and parents—by blogging and using wikis.

- Second graders assessing their own performance, guided by software programs matched to what they knew and helping them progress.

- Teams of third graders working collaboratively and creatively to design their own power points, streaming in videos and music from the Internet.
• Fourth graders assessing what they’ve learned in real time by recording math and science answers on handheld digital devices, i.e., “clickers,” with their teachers differentiating instructional strategies accordingly.

• Fifth graders personalizing their knowledge of cultures and foreign languages in conversation, via teleconferencing, with students from other countries.

• English language learners and special education students overcoming communication barriers and staying on task, aided by computer touch screens.

• Hearing disabled students communicating effectively with their teachers through handheld devices that recorded their answers.

• Middle schoolers honing their technology literacy skills through a rigorous certification program and staying current with their assignments and course requirements via access to computers in school after school.

• High schoolers immersed in project-based learning activities, the results captured in individual digital portfolios enriched by accessing multiple websites, online learning courses, social networks, and community expertise.

The Classroom Had Welcomed the Digital World Inside—and Vice Versa.

In essence, CSD was using technology to create a school culture in which everyone shared responsibility for delivering on high expectations. Students, beginning in elementary school, were taught to assume control over their own behavior and to reflect not just on what they were learning, but why and how. Teachers worked collaboratively to enhance learning opportunities for their students and resolve any problems. New teachers helped their veteran colleagues navigate the Internet—and benefited, in turn, from having their more experienced peers share proven instructional and classroom management practices. CSD leaders also incentivized innovation by encouraging schools to pilot new ideas that addressed district priorities.

A Financial Gut Check Forces Tough Choices and Reveals New Possibilities

And yet...Despite having made great strides, CSD was not immune from the challenge trifecta confronting school districts nationwide. A stalled economy, plummeting property values, and persistent unemployment unleashed intense competition over dwindling public revenues. Students coming to school had diverse learning and social needs that required individual attention. And the future, both on the domestic and foreign policy fronts, felt more unsettling and unpredictable than ever.
Budget cuts were unavoidable. Determined that fiscal conditions not impede district progress, CSD leaders took decisive action. Initially, they looked inward to reduce costs. Painful as it was, the school board approved the superintendent’s recommendation to increase class size, confident that teachers could absorb additional students without having instruction suffer, since most class work was team-based and since hand held devices gave teachers the ability to monitor student progress in real time.

Next, CSD leaders appealed to the school community on equity grounds. Students with laptops at home were asked to bring them to school. The district then leveraged its resources by providing computers to less fortunate students who would own their laptops at graduation in return for maintaining high attendance rates and passing grades. The district also appealed to libraries and other local entities to make computers available to students after school and over the weekends. These formal agreements would prove essential should, worst case scenario, CSD need to reduce the number of school hours or days or eliminate summer school in order to save money.

The district also took advantage of its learning management system to communicate with the greater community. The superintendent expanded the district’s public/private partnerships by creating what CSD called its IN/Vested Interest Initiative. Schools identified their project-based learning “wish lists,” which the central office then matched with external expertise from government, business, colleges and universities, and other community resources, both locally and globally. CSD recruited numerous individuals who might not have children in the school system, but who nonetheless welcomed the chance to get involved. The district also mounted an active campaign to involve retirees and second careerists in working with CSD students and teachers. In addition, CSD forged a close working relationship with state education policymakers, enabling the district to share the results of its own initiatives as well as align with state policies aimed at accelerating student readiness for college and work.

Finally, to reduce costs and enrich instruction, district leaders explored pooling resources with other jurisdictions. They looked into creating a private community cloud with other public sector entities to store their collective data as well as developing online courses with other school districts and universities to enrich the CSD curriculum.

**Transitioning From Teaching to Learning**

For years, CSD principals and teachers had been saying, “if only we could document achievement that captured what students do in class...” Well, now was their chance.

The superintendent’s office had recently issued a challenge: Let’s make learning a shared enterprise. It invited schools to submit proposals on how to involve CSD students, not just as beneficiaries of learning, but as active producers.

The challenge was based on several common sense assumptions: Since students outnumbered everyone else in school, engaging them more actively could yield sizeable productivity gains in learning, particularly if every student, based on his or her individual interests and experiences, had the chance to contribute. And if the vast amount of information that bombarded students from outside school was brought inside, then teachers could help their students become more discerning thinkers.
Logan’s Idea Acquires a Fan Base

And that’s where Logan James’ idea came into play. Over lunch, Logan’s teacher Nate Evans paid his principal a visit.

The idea was simple, Evans told her. During the next few weeks, his students would begin designing online games in their computer science class. After having talked to his younger sister Casey about her fifth grade project on Alexander the Great, Logan had come up with the idea of creating a game that featured leaders throughout history. Students could pick their favorite world figure and then compete, based on their knowledge of that era or ability to solve problems grounded in history. “Many teachers ask for our help in finding information online or fixing their computers,” Logan had confided to Mr. Evans, although it was hardly the best kept secret. So, “why not have students design digital games that teachers could use in class?”

Principal Jenny Kim smiled. Given the superintendent’s recent challenge to the schools, Logan’s idea had a certain appeal. Both teachers and students were used to working in teams, so why not combine such efforts in the classroom? Many teachers, as Nate Evans had reminded her, were already comfortable asking students for help with all things technical. Still others would come on board once they witnessed the excitement and potential performance gains of their students. The technology specialists could facilitate the discussions so her faculty would not feel intimidated by students who knew more about technology than they did. Rather than overload teachers with yet another new thing, especially when so many were already stressed out by having to meet state and federal accountability requirements—this initiative, if implemented effectively, would reenergize school to everyone’s benefit.

After gaining buy in from her faculty and staff, Jenny Kim submitted Logan’s idea to the district, fully aware of the profound implications for teaching and learning. If the idea caught on, it could conceivably alter how student performance would be defined and results measured; how teachers would need to be prepared and supported; and how accountability would emerge, ultimately, as a shared responsibility between students and their teachers.

The Board of Education Gains Valuable Insights on Learning

At the end of each school year, the superintendent and school board dedicated a board meeting to showcase and learn from exemplary classroom practices districtwide. This year, they had invited Casey James’ class to participate. Following the presentations, board president Anthony Garcia asked Casey to share her thoughts about the team’s project.

“Our teachers don’t want us to rely on them for the ‘right answers’,” Casey explained, “so they asked us to pick a leader from the period we wanted to study. Three of us wanted to learn more about Alexander the Great so we worked together on the research and preparing the presentation. It was really fun and I learned a lot,” the fifth grader concluded.
Next, Mr. Garcia asked Casey’s teacher about the program’s goals. “The students spent five weeks collecting information from online sources, books, and videos to create a multi-media presentation,” he explained. “The teams from my class then shared their presentations on the various leaders and cultures with all of the fourth and fifth grade classes so that everyone benefits from the information.

“Having students search for information online expands their analytical abilities,” the teacher observed. “We want our kids to understand the ‘big ideas’ underlying social studies. Then they can see how their world has been influenced by the past, which gives them a better sense of themselves moving forward.

“In our class, learning is not about preparing students for life,” the teacher concluded. “Learning is their life.”

Nate Evans had been listening to the discussion from the back of the room. As the meeting adjourned, he thought to himself: “Centuries ago, Alexander the Great had conquered the world and altered the course of history. Today, another worldwide invasion—armed with limitless information and communications—was about to transform civilization once again.”

Welcome to the Digital Era, Ancient Alex, and the Many Challenges Yet to be Conquered!

So, What Will It Take?

Every day, countless school districts confront the conditions encountered by “Central School District” in the previous scenario. And countless districts pursue a similar course of action. Like CSD, they have, are, or would like to use technology to:

• Engage the greater community in articulating a new vision of teaching and learning—based on emerging trend data that paint a comprehensive, realistic picture of the future.

• Formulate and implement a long-term strategic plan based on the community vision, positioning technology to enrich instruction through professional learning opportunities, technical support, ongoing data, and efficient operations.

• Encourage and support schools to propose, pilot, disseminate, and scale innovative practices—and involve parents in all aspects.

• Enrich instruction—and potentially transform the basic teacher/learner relationship—by incorporating, within school, the ways in which many students interact with technology outside of school.

• Treat technology—not as a discretionary expenditure in the face of cutbacks—but as an essential investment in helping students develop the requisite skills to map their own futures.

• Reposition a fiscal crisis as the opportunity to “blue sky” innovative approaches to learning and teaching.
• Build an information and communications infrastructure that can expand and sustain improvements.

• And—perhaps most critically when it comes to making key decisions—involves students, teachers, administrators, technology specialists, parents, and community members in the same, ongoing conversation.

What Pressure Points are Driving School Districts to Move in This Direction? Part Two Contains a Number of Answers.

PART TWO

Reality Check

The previous scenario was part invention, part aspiration. The drivers of change on which the narrative was based, however, are real. They impact students, teachers, funding, policy, and technology. Together, they frame the challenges and opportunities confronting school districts today and that may well determine the fate of public education in the not so distant future.

What follows is a snapshot of all five issues. A snapshot will suffice, however, to underscore the complexity inherent in transforming education: although each issue is discussed individually, they need to be acted on collectively.

I. Students are Falling Behind Academically, Are More Diverse, and Are Growing Up Digital

To prepare students successfully in the 21st century, educators will need to address three challenges simultaneously. First is the need to raise student achievement by insuring that more students graduate and when they do, they are ready for college or to pursue a career.

Making it through high school for too many students is hardly a given. Figure 2.1 indicates just how difficult it has been. High school completion rates improved steadily over most of the past decade, but began to lose ground during 2006 and 2007. Nationally, 1.3 million members of the public high school class of 2010 will fail to graduate with a diploma. This amounts to a loss of 7,200 students every school day or one student every 25 seconds.iii
Having students stay in school is only half the battle. Insuring that they are well prepared once they graduate is the other half. Failure exerts a huge toll, not only in human terms, but on the society as a whole. Figure 2.2 illustrates how far the U.S. has slipped, compared to other developed countries in science and math. In 2006 (the most recent international comparisons from the Program for International Student Assessment, PISA) the average science literacy score of 15-year-old students in the U.S. placed them in the bottom third of participating OECD nations. In math literacy, the rankings were even lower.iv

These secondary school results have serious ramifications once students turn college age—and on which undergraduate degrees they are not earning. In 2005, Tapping America’s Potential (TAP) a coalition of 15 business organizations set a stretch goal to double the number of STEM (science, technology, engineering, and mathematics) undergraduate degrees awarded in the U.S. to 400,000 by the year 2015. Their reason: “Failure to change the status quo places America’s future economic and technological leadership at risk.”v  By 2008, TAP reported only a 12 percent increase of STEM undergraduate degrees awarded. Clearly, we have a long way to go.

The intent is not to castigate U.S. students or their schools, but rather to highlight on their behalf—and the country—what’s really at stake.

A second challenge confronting education is the need to personalize instruction. Today’s students come to school with a vast array of aspirations, experiences, and learning needs. Raising the performance bar for all students, therefore, means customizing instruction for each. Figure 2.3 illustrates the existing consequences of not personalizing education enough, based on current college completion rates of students according to their racial and ethnic backgrounds.
A third challenge is relevancy. For growing numbers of students, the digital world they experience outside of school—and that will factor increasingly in their lives as adults—differs markedly from their experiences once inside school. Unless the two realities become one, educators will be denied a powerful resource that can unleash for students the intrinsic power of learning for learning’s sake.

Dealing with one of these challenges would be daunting enough. Dealing with all three challenges at once requires enormous insight and fortitude. Educators must personalize instruction for an increasingly diverse student population, while simultaneously helping all students hone their ability to meet emerging expectations—content and skills, as well as the ability to integrate the use of both in an increasing unpredictable world. Figure 2.4, which lists the “Twenty-First Century Student Outcomes” developed by the Partnership for 21st Century Skills, illustrates the scope and depth of the challenge.

Students also want a place at the table, according to “Speak Up 2009,” a national survey highlighted in Figure 2.5. And they are not shy about expressing their preferences.

### How Schools Can Ease Technology Use: Top 5 Student Responses

1. Using their own cell phone or smart phone or MP3 player
2. Using their own laptop or netbook
3. Unlimited internet access throughout school
4. Provide access to my social networking sites
5. Provide the tools to help me communicate with my classmates

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**Figure 2.3 Source:** IES “Fast Facts,” National Center for Education Statistics, U.S. Department of Education, (2009); http://nces.ed.gov/fastfacts/display.asp?id=40

**Figure 2.4 Source:** Partnership for 21st Century Skills, http://21centuryskills.org/

**Figure 2.5 Source:** Project Tomorrow, “Speak Up 2009,” 3/2010, national survey findings, www.tomorrow.org/speakup/
Bottom line: In transforming from a teaching to a learning model of instruction, educators will be challenged to rethink, fundamentally, not only what students should be learning, but also why, how, and to what end—not just for students, but with them. No easy task by any set of measures.

II. Teaching Must Become More of a Collaborative Endeavor

If learning is changing, so must teaching. The traditional model of one adult in front of a classroom of students, while familiar to all and cherished by some, is no longer viable. Here’s why.

The number of prospective teachers moving through the workforce pipeline will not offset those leaving the profession, according to trend line data provided by the National Commission on Teaching and America’s Future (NCTAF) and depicted in Figures 2.6 and 2.7. Contributing factors: the pending retirement of Baby Boomers, but even more so, the high turnover among younger teachers.

According to NCTAF, U.S. schools during the last ten years:

- Hired 2.25m new teachers
- Lost 2.8m teachers
- Lost 677,000 teachers to retirement
- Lost 2.12m teachers to non-retirement

Changes in teacher supply and demand, coupled with increasing pressure to improve student performance, are also prompting a fundamental reassessment of the profession itself—from how teachers are prepared and recruited to how they are supported with ongoing professional learning opportunities, evaluated, rewarded and retained.
At issue is the shift from teacher as a single individual to the concept of teaching as a collaborative endeavor. The good news, indicated by Figure 2.8, is apparent receptivity on the part of prospective participants willing to share the responsibility as well as teachers and principals who would welcome their input. Included in the new mix are individuals who envision teaching as either a short-term, public service commitment or a long-term, professional endeavor; second careerists or retirees; and business, government, or community representatives willing to lend their particular expertise. Tapping their experiences could energize school, not only for students but for veteran teachers as well.

### Opportunities to Enrich the Practice of Teaching

**Baby Boomers:**
- 65% (49m) Want to work after retirement
- 55% (27m) Are interested in teaching or education
- 75% of teachers and 78% of principals feel the current stand-alone teaching model is outdated
- 70% of teachers and principals react positively to the concept of cross-generational teaching

Technology can also play a pivotal role in transforming teaching. If available in classrooms, it should help attract to the profession younger individuals who have grown up digital. If used to engage students, technology should also appeal to veteran teachers motivated intrinsically by any resource that helps them connect with their students.

The ramifications for preparing and supporting teachers, regardless of their respective ages or motivations, are far-reaching. According to the International Society for Technology in Education (ISTE), teachers in a digital world will need to meet five standards.

1. Facilitate and inspire student learning and creativity
2. Design and develop digital-age learning experiences and assessments
3. Model digital-age work and learning
4. Promote and model digital citizenship and responsibility
5. Engage in professional growth and leadership

Consequently, teachers, like their students, need access to state-of-the-art technology. They also need ongoing support in using the technology effectively—in the classroom as well as in the programs that prepare them for the classroom.

### III. Funding Cutbacks Mean Doing More—and Doing it Differently—with Less

Education received a fiscal reprieve when federal stimulus dollars offset potential massive layoffs during 2009-10. Unfortunately, the relief proved short-lived, as state and local education officials predict dire financial conditions ahead.

According to a recent survey of state budget officers, “Fiscal 2010 presented the most difficult challenge for states’ financial management since the Great Depression and fiscal 2011 is expected to present states with similar fiscal challenges.” The view from local school districts is no better. “School administrators across the nation are faced with the possible reality of eliminating an unprecedented number of teaching jobs for the 2010-11 school year,” according to a survey of local school superintendents.
A sharp decline in state and local revenues is likely to force substantial cutbacks, even with but particularly without another federal reprieve. All of this is happening when educators, as never before, are being challenged to prepare an emerging workforce that can revive the economy and when the sense of urgency, following years of demands on the schools to improve, may have lost its resonance.

Addressing such financial pressures places education leaders at a critical crossroads. In making the cuts, will they be more inclined to safeguard existing programs and stick with familiar practices? Or, will they use the fiscal emergency to embrace more disruptive options, ones that may mean eliminating or reconfiguring jobs in favor of upgrading technology? The latter course is far more controversial to be sure, but it may also yield more promising results for students in the long run.

IV. Policy Opportunities for Convergence and Innovation

Education in the U.S., unlike most countries, is primarily a state responsibility ensconced in a strong tradition of local control. That said, the tenor of policy reform debates has been changing recently. Growing is the recognition that when compared to other countries, 50 different state definitions of performance in the U.S. based on where students happen to live, are hampering our ability as a nation to accelerate improvement. Enacting national academic standards is a bridge too far, but common core standards are the bridge that many state education leaders appear willing to cross. In fact, 48 states initially endorsed such an effort to articulate English and mathematics standards for each grade level, K-12.

After extensive development and vetting, the Council of Chief State School Officers and National Governors Association jointly released the final version of the standards on June 2, 2010. Mindful of local prerogatives in education, a Common Core factsheet stated, “Standards do not tell teachers how to teach, but they do help teachers figure out the knowledge and skills their students should have so that teachers can build the best lessons and environments for their classrooms. Standards also help students and parents by setting clear and realistic goals for success.” State collaboratives currently are developing common assessment models to track the results. Only time, measured by subsequent action in each state, will determine whether these efforts live up to their promise.

In the meantime, a rare convergence among the federal government, state governments, and private foundations is also evolving. It focuses on efforts to raise the rigor of state standards, improve teaching practices, and accelerate gains in struggling schools and for struggling students—using, as key drivers, a mix of comprehensive/longitudinal data systems, innovative practices, charter schools, and targeted accountability systems. Race to the Top (RttT) initially provided $4.35 billion in federal competitive grants to states that sign on to address four priorities:

1. Adopt internationally benchmarked standards and assessments that prepare students for college and workplace success.
2. Recruit, develop, retrain, and reward effective teachers and principals, including tying teacher effectiveness to student performance.
3. Build data systems that measure student success and inform teachers and principals on how to improve their practices.
4. Turn around struggling schools, including increasing the number of charter schools.
The federal government, matched by a number of private foundations, is also leveraging sizeable resources to spur innovation and the scaling of successful practices. Investing in Innovation (i3) will provide $650 million in competitive grants to local school districts and non-profit organizations, aligned to RttT priorities and requiring a 20 percent match in funding. There are three grant categories:

1. Development grants will provide up to $5m per grant for promising initiatives, attempted previously.
2. Validation grants will provide up to $30m per grant for initiatives that can document existing evidence of impact and are ready to expand.
3. Scale Up grants will provide up to $50m per grant for initiatives that can document strong evidence of impact on achievement, with the potential to reach hundreds of thousands of students.

Thirty-two foundations have registered with the Department of Education to provide the match. Applying for the federal competitive grants is voluntary. Yet the lure of winning, accompanied by a hefty revenue infusion, is having a major impact in many cash-strapped states and communities. Policymakers in a number of states, for example, have amended their education laws to authorize or expand the numbers of charter schools and/or include student performance gains as a measure to evaluate and reward teachers.

Whether states are motivated by financial desperation or heartfelt commitment is an open question. Whatever their reasons, however, the grantees will have a chance to implement promising ideas, document what works, and scale successful practices—all laudable objectives.

Because education policies frame the rules of engagement, literally, for practitioners, the impact on school districts could be substantial.

V. Technology Simultaneously Challenges the Status Quo and Offers Alternative Solutions

Access to the Internet has become a fact of life in virtually all school districts, according to data released by the National Center for Education Statistics and summarized in Figure 2.9. Unfortunately, the data are less encouraging when it comes to accessing specific technology tools (such as computers, interactive technologies, and hand held devices) in the classroom as well as training, and expertise. Moreover, availability and effectiveness are not necessarily synonymous. Students and teachers not only need cutting edge technology. They also need ongoing support in learning how to use technology successfully and ample occasions to do so.

**Education Technology in Public Schools: Current Use (2008 data)**

- An estimated 100% of public schools had one or more instructional computers with Internet access; the student to computer ratio was 3:1
- Use of handheld devices: 49% of administrators, 15% of teachers, and 4% of students
- Use of interactive whiteboards: by 73% of public schools
- Schools with full time technology staff: 31% of public schools
- Gaps still exist between schools with high and low concentrations of poverty when it comes to access, training, and technology staff

Figure 2.9 Source: National Center for Education Statistics, “Education Technology in U.S. Public Schools: Fall 2008,” April 2010; see: http://nces.ed.gov/pubs2010/2010034.pdf
Both the Federal Communications Commission (FCC) and the U.S. Department of Education strongly favor extending broadband Internet access and wireless connectivity within and outside of schools. Such initiatives, coupled with the Obama Administration having made government information more transparent and accessible, could help local educators blur the existing boundaries between school, work, and the community as they reach out to parents, voters, and other local entities in determining the future of their schools.

And school districts will need their support. According to ISTE, seven factors must be addressed before technology can achieve its potential as a powerful instructional tool:

1. Effective teacher professional development in using technology in instruction
2. Application of technology aligned to local/state curriculum standards
3. Technology incorporated into daily learning activities
4. Individualized feedback provided to students and teachers
5. Student collaboration in using technology
6. Project-based learning and real world simulations to motivate students
7. Teachers, administrators, and community members/parents who lead, support, and model effective technology integration

Clearly, technology is in a race, competing for attention and funding with the mounting number of concerns that educators must address. Technology also is competing for understanding and support from a public forced to choose among numerous priorities.

And technology is in a race with itself, indicated by the number of new tools and applications on the horizon for education listed in Figure 2.10. Emerging technologies can either accelerate learning opportunities for all students or widen the gap between the haves and have-nots. They can either spark new learning discoveries or, by getting too ahead of school districts, threaten their relevance. And emerging technologies can either expedite the way that growing numbers of students want to learn in school or, by their absence, further tune students out.

At This Point, the Race Could Go Either Way.

### K-12 Schools: Technologies to Watch (2010)

#### Near term horizon (one year or less)
- Cloud computing
- Collaborative environments (shared, user-created content)

#### Second adoption horizon (2-3 years)
- Game-based learning
- Mobile devices

#### Far-term horizon (4-5 years)
- Augmented reality (GPS, video, pattern recognition)
- Flexible displays (touch-based interfaces; interactive displays)

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In summary, school districts are dealing with numerous moving parts and participants. These five drivers—involving students, teachers, funding, policy, and technology—can help them:

- Personalize learning, both for and with each student;
- Make teaching a collaborative practice;
- Position the pending fiscal crises to address cutting edge solutions, overlooked or quashed during more normal times;
- Align district transformation with converging state performance expectations and to scale innovative practices; and
- Use technology to accelerate change and enhance productivity.

School districts do not have the luxury of prioritizing one or two of these issues; they will need to consider all five simultaneously. This reality check underscores why education transformation is needed and why it will be so challenging.

It is also explains why Part Three of this paper addresses potential solutions.

PART THREE

Making the Connections

Implementing decisions today that must, ultimately, serve students over a lifetime of tomorrows is an enormous responsibility, particularly when the margin of error in the current economic and political climate is so unforgiving.

With much at stake, school districts need not confront these challenges alone, however. Having spent 25 years listening to educators as demands on school systems have escalated, Dell has created The Connected Classroom, depicted in Figure 3.1.

![The Connected Classroom](image-url)
The Connected Classroom, utilizing Intel technology, represents a comprehensive array of tools and services that can help school districts simultaneously address the five pressure points—impacting students, teachers, funding, policy, and technology—discussed in Part Two. Here is how:

**Engage Students as Active Learners**

Dynamic classrooms extend their reach beyond a particular location. They enable students to connect with the world via laptops, netbooks, and latitude tablets. Students can uncover information and discover new ideas, both individually and collectively with other students and their teachers, via ongoing Internet access. In such an environment, students can capture what they learn by using digital cameras, videos, audio software, and digital content and then share it with others through portals, blogs, wikis, and video conferencing. Students can take more responsibility for learning by using handheld devices and assessment software that provide them with ongoing feedback based on what they do know so they can learn even more. Such a classroom incentivizes inquiry and inspires creativity, enabling students to develop, early on, into lifelong learners.

**Support Teachers Collaboratively to Personalize Student Success**

Classrooms connected by technology help teachers focus their time, energy, and skills on learning—that of their students as well as their own. Teachers can ascertain in real time the level of understanding of each of their students by using student response systems. At the same time, they can make learning a collaborative experience. Teachers can develop their own skills by participating in Dell professional learning courses on how to conduct formative assessments, facilitate collaboration, engage students in individualized learning, and communicate effectively with parents. In essence, such opportunities will help accelerate the transformation of teaching into a collaborative endeavor.

**Create a 24/7 Learning Environment**

Digital classrooms powered by the Internet make learning possible, any time and anywhere. The variety of devices, coupled with secure access to school networks and fortified by a comprehensive learning management system, extend learning time for both students and teachers. They enable parents and other adults to join in by reinforcing learning at home and in the greater community. And they position school districts and communities to define measures of success and then design a reporting system to capture the results.

**Provide the Infrastructure That Will Support a Dynamic Learning System**

For classrooms to stay connected, operations need to become seamless. School districts must have the capacity to install programs effectively; diagnose emerging needs; address security issues, physical threats, and network weaknesses; and plan for disaster recovery and backup. The mounting budget crisis, in particular, will try the resourcefulness of district leaders to devise strategies that can sustain ongoing technical innovation and support.

By extending the classroom 24/7, Dell can help school districts capture evidence of transformation. Technology can simultaneously enrich instruction in real time and document the results for other key constituents of learning—administrators, technologists, parents, and communities—to become informed so they can become involved. The Connected Classroom is the nexus of this larger learning infrastructure, depicted in Figure 3.2.
Sustain Public Support and Community Engagement

Each of these constituencies has its unique needs and responsibilities to be sure. Yet none can transform learning in isolation. Their success, both individually and collectively, will depend on having concrete evidence and direct access to what happens when students and teachers interact, both personally and virtually. Only then will another important stakeholder group—policymakers—be able to fulfill its responsibility to frame policy and provide funds that enrich, expand, and sustain classroom-based activities. And only then will the public be able to fulfill its oversight responsibility as citizens and taxpayers to ensure that education is preparing generations of learners successfully for the future.

Putting the Parts and Participants Together: Some Examples

State by state adoption of new standards and assessments will refine and provide needed consistency to performance expectations nationwide. But only students, supported by their schools, parents, and communities, can deliver the intended results. Therefore, policymakers eager to accelerate student mastery of knowledge and skills in real time should welcome opportunities to learn from what happens inside the 24/7 classroom.

Sustaining innovation once external grants run out and initial champions move on is a perpetual challenge in education. Therefore, policymakers eager to prolong the impact of the federal Race to the Top and Investing in Innovation grants should welcome opportunities to enlist grassroots support for their efforts, the ultimate value of which will be validated by what happens inside the 24/7 classroom. As policymakers and practitioners attempt to document the relationship between teacher effectiveness and student performance, technology’s capacity to provide students and teachers with instant feedback will become increasingly apparent. By making instruction more manageable, more accessible, and more transparent, the 24/7 classroom should reinforce the collaborative nature of learning itself.

The Connected Classroom utilizing Intel technology can help align all of these moving parts and participants. It can support them collectively to do what they have to do, what they want to do, and to do it well—realize and act on a new vision of learning and teaching, one truly reflective of our evolving times.
A conversation worth catalyzing and sustaining. Dell and Intel invite you to join in.

>> For additional information, please visit www.dell.com/k12 and http://www.intel.com/inside/education/index.htm or contact your Dell sales representative at 1-800-283-6633.

Dell commissioned Peggy M. Siegel to write this paper. Dr. Siegel has been actively involved within the public, private, and non-profit sectors—and has written extensively about education change initiatives for over 30 years. She can be reached at: EducationFreeAgent@verizon.net.

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Casey's project is based loosely on actual events. On April 19, 2010, the author visited Colvin Run Elementary School in Fairfax County Public Schools, VA. One of the student teams in Gary Cole's fifth grade integrated social studies/technology class had decided to compare Alexander the Great and Hitler as part of the school's Global Awareness and Technology Project Initiative. Mr. Cole graciously provided background information during and at the end of the project, which has been incorporated into this fictional scenario.

Based on a comment made by Gary Cole, fifth grade teacher, Colvin Run Elementary School, Fairfax County Public Schools.


National Commission on Teaching & America’s Future presentation, www.nctaf.org

For additional information see the National Commission on Teaching & America’s Future website dedicated to accelerating the implementation of learning teams: http://www.learningteams.org/


For a final copy of the Common Core State Standards, see: http://corestandards.org/the-standards


For additional information on efforts to develop collaborative state assessment models, see the Center for K-12 Assessment & Performance Management website: http://www.k12center.org/

Race to the Top, for additional information: http://www.ed.gov/programs/racetothetop/index.html

For additional information on the foundations that have signed on to provide the match to the Investing in Innovation Initiative grants, see http://www.ed.gov/programs/innovation/index.html; http://foundationregistryi3.org

For additional information on the education sections of the Federal Communications Commission “National Broadband Plan, Connecting America,” see: http://www.broadband.gov/issues/education.html. ; For additional information on the U.S. Department of Education National Education Technology Plan, see: http://www.ed.gov/technology/netp-2010