Technology for Learning:

A Guidebook for Change

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Table of Contents

Introduction

A Nation at Risk, the 1983 report on the status of schools in the United States, found that the system as a whole was deficient. The report stated, "Declines in educational performance are in large part the result of disturbing inadequacies in the way the educational process itself is often conducted. The four most important aspects of the educational process were content, expectations, time and teaching."

Twenty-seven years later, a crisis continues to exist. As Secretary of Education Arne Duncan has said, the current state of our educational system is ""economically unsustainable and morally unacceptable." In this century students need new abilities as well as traditional skills. The good news is that schools have new tools to help them change the system and improve students' learning.

The National Education Technology Plan 2010 says, "Technology itself is an important driver of change. Contemporary technology offers unprecedented performance, adaptability, and cost-effectiveness." This guidebook looks at an essential component of change: providing universal access to technology to improve the educational process.

Digital Students and Analog Schools

We call today's learners Millennials, Generation Next, or the Net Generation for good reason. They use communications, media, and digital technologies almost instinctively. They are connected, wired for the next moment's activities, and view the world through the prism of their own interests. This worldview is different from that of previous generations and the difference affects their learning significantly. Within the context of their interconnected, always-on world, the path to student engagement has changed.

Young people carry personal communications devices and can text friends at will, get answers to questions, and stay in touch. According to the 2010 Horizon Report, K–12 Edition, "beyond the classroom walls, students can take advantage of online resources, explore ideas, and practice skills using games and other programs they may have on systems at home, and interact with their extensive—and constantly available—social networks."

All too often when students come to school, they must turn off their devices and adjust to a world that exists nowhere but in that building. The Horizon report says, "Within the classroom, learning that incorporates real-life experiences like these is not occurring enough and is too often undervalued when it does take place."

In fact, Project Tomorrow's 2009 Speak Up report *Creating Our Future: Students Speak Up About Their Vision for 21s- Century Learning* says, "Today's classroom environment does not mirror the way today's students are living their lives outside of school."

While no one would advocate allowing students to spend school time on purely social activities, schools can leverage students' facility with and dependence on electronic devices to build a connection from outside classrooms to inside them and engage students in learning while also building essential technological competencies. Schools focus on student achievement, but only students who are engaged can achieve. Clearly, providing technology for students' use is one important aspect of engagement.

Trends

The Horizon Report identifies five key drivers of technology adoptions that are promising.

- Technology is increasingly a means for empowering students, a method for communication and socializing, and a ubiquitous, transparent part of their lives.
- Technology continues to profoundly affect the way we work, collaborate, communicate, and succeed.
- The perceived value of innovation and creativity is increasing.
- There is increasing interest in just-in-time, alternative, and nonformal avenues of education, such as online learning, mentoring, and independent study.
- The way we think of learning environments is changing.

Transforming Schools

In the real world, each person has at least one device to use as his or her own. Thus in schools, the move to anytime, anywhere computing—providing access to technology for learning to all students—makes sense. Research from Project RED in 2010 shows that the lower the student-to-computer ratio, the greater the improvement in students' learning. Thus programs that provide access have the potential to drive student achievement.

Five objectives outlined in the National Education Technology Plan 2010 are the foundation of today's educational ecosystem: learning, assessment, teaching, infrastructure, and productivity.

The goals are:

1. **Learning: Engage and Empower** All learners will have engaging and empowering learning experiences both in and out of school that prepare them to be active, creative, knowledgeable, and ethical participants in our globally networked society.

2. **Assessment: Measure What Matters** Our educational system at all levels will leverage the power of technology to measure what matters and use assessment data for continuous improvement.

3. **Teaching: Prepare and Connect** Professional educators will be supported individually and in teams by technology that connects them to data, content, resources,

expertise, and learning experiences that enable and inspire more-effective teaching for all learners.

4. **Infrastructure: Access and Enable** All students and educators will have access to a comprehensive infrastructure for learning when and where they need it.
5. **Productivity: Redesign and Transform** Our educational system at all levels will redesign processes and structures to take advantage of the power of technology to improve learning outcomes while making more efficient use of time, money, and staff.

To reach these objectives, schools can implement the methods below. Technology enables and enhances each. In fact, change and technology are intertwined.

- Become learner-centric.
- Modify curriculum and instruction to seamlessly integrate "universal" (formerly known as"21st-century") skills and knowledge.
- Engage the anytime, anywhere, 24/7 model of lifelong learning.
- Adapt and adjust to personalize learning processes.
- Incorporate state-of-the-art technologies in meaningful, engaging, and relevant ways.
- Use the power of technology to increase efficiencies and productivity.
- Provide pervasive, equal opportunities for learning.
- Aggregate and analyze data on a systems level.
- Ensure consistent, coherent professional-learning experiences.
- Use research and development to continually seek and define organizational best practices.

Student Learning and Access to Technology

The original term "one-to-one computing" meant that every student, teacher, and administrator would have 24/7 access to a computer and software that could lead to anytime, anywhere, any-way learning. Currently in schools, a more realistic view includes one-to-one, one-to-many, virtualized environments, labs, virtual learning, and using a wide range of devices. K–12 technology programs take many forms these days. Some percentage achieves one-to-one, but many have a combination of types of learning environments.

Technology continues to profoundly affect the way we work, collaborate, communicate, and succeed.

Universal access means the availability of online tools and resources 24/7, with technology platforms for more personalized and more individualized learning. Companion tools such as cell phones and handheld devices can provide additional resources and connectivity for students without a computer at home or for specialized tasks. Today devices come in many forms and provide many options for learning. A full-functioning Web-accessible device with 24/7 access is best.

With this access, teachers can make assignments based on how students learn and on the data gathered from individual work. According to the *Mobilizing the Millennials* report, "each student responds uniquely to specific classroom environments and instructional practices based on what they already know and how they are wired to learn. Each student's cognitive approach is as individual as his or her physical makeup."

In addition, "equipping classrooms with sufficient workstations or laptop carts is essential to ensure that each student has access to a networked computer in each classroom and essential student data can be collected, allowing teachers to make data-driven decisions to individualize teaching and learning."

Teachers can use state-of-the art technologies to help students develop the universal skills of research, critical thought, collaboration, problem solving, communication, creativity, innovation, metacognition, and global connection. A learning environment of personalization, rich media, dynamic resources, and immediate connectivity is the catalyst for helping students acquire these crucial skills.

Today's "classroom" is located wherever there is the potential for instruction and learning to occur. Virtual classes, online sessions/collaborations, Web-based instruction modules, and access to dynamic digital resources are examples of "classrooms" that can happen anytime and anywhere there is connectivity and a student. Four brick-and-mortar walls are not required.

In traditional schools, certain methods work well with technology to engage learners and make content meaningful. Research shows that techniques such as project-based learning, collaboration, hands-on learning, and constructivism make a difference. Clearly, technology enables teachers to institute such learning practices and students to engage in the activities that will motivate them to achieve to their potential.

Technology is a vehicle, an enabler, that is only as effective as those using it. The tools must support, not supersede, educational goals related to content and outcomes. Educators have to drive student achievement by using the power of technology, not by having the technology drive them. Professional learning must be aligned with the objectives, assessments, structures, and processes that demarcate the school or district.

If schools are going to improve, we must learn from best practice and institute sweeping, systemic change. According to a new report from the Organisation for Economic Co-operation and Development (OECD) says, "While there seems to be clear support for a systemic approach to technology-based school innovations, particularly when it comes to the complex issue of assessing them and using validated evidence to decide upon their scaling up, there is also the recognition that this new approach challenges predominant assumptions about innovation in education. Governments and teachers alike need to rethink how innovations are supported, monitored, and assessed, whether the right strategies and tools are in place and used to their full potential, and finally whether the whole discussion about technology in education has to be redefined in light of what we all should be caring about: the quality of students' learning."

Using technology to achieve systemic change requires many components and people. These include understanding the computing needs of learners and educators; planning for the future; establishing policies and procedures; providing effective leadership and professional development; understanding digital content; and providing classroom management, assessment, infrastructure, funding, and program evaluation. In addition, systemic change must be sustained.

Purpose of This Book

Simply having the tools in teachers' and students' hands doesn't guarantee achieving educational goals. This document provides a guide to creating effective, robust technology initiatives based on real-life practitioners' successes. It is based on the complex confluence of variables that affect today's schools.

More than ten years of research, practitioners' observations, and best practices have affirmed the ingredients that are key to K–12 technology projects' achieving the overarching goals of:

- equal access to education for all
- personalization of learning and teaching
- increased student engagement and achievement
- development of "universal" skills and competencies for the global workplace
- just-in-time student assessment, data gathering, feedback, and adjustments
- communication between home and school

What follows is an overview of each chapter.

Chapter 1: Understanding Technology for Learning

Universal access to technology means that it is present everywhere. It exists in many aspects of our lives today; however, one place where universal access has not yet taken hold is in our schools. This chapter presents a framework for understanding universal access to technology: the promises and challenges for learning and how to assess school and district preparedness.

Chapter 2: Planning for E-learning

Implementing a program that relies on technology for learning means advance planning and careful preparation. Planning it is a complex and detailed process that is tied to the organization, culture, and personnel involved. To achieve goals and sustain a robust program, school districts have to lay the groundwork and engage all stakeholders in setting expectations, making decisions, establishing benchmarks and timelines, and achieving consensus.

Chapter 3: Establishing Policies and Procedures

The National Education Technology Plan 2010 encourages us to be clear about the outcomes we seek; collaborate to redesign structures and processes for effectiveness, efficiency, and flexibility; monitor and measure our performance; and hold ourselves accountable for progress and results. We need policies and procedures that will enable us to carry out the plans.

Chapter 4: Driving Effective Leadership

In education, leaders are charged with inspiring and managing educators, students, school boards, and others in the community in order to achieve common goals. Strong leaders should be honest, competent, and intelligent and be able to lead others to understand and share in the mission of excellent personal performance and high student achievement. Such leaders exist at all levels within an educational system.

Chapter 5: Creating Professional-Development Systems

Professional development is essential to building the capacity of teachers to create classroom transformation. Formal systems for ongoing professional learning can lead to transforming educational environments, raising student achievement, and ultimately creating high-performing schools. Professional-learning experiences can be conducted face-to-face, facilitated online, or provided with blended methods.

Chapter 6: Using Digital Content in Curriculum

We can define digital content as electronic images, text, video, and sounds. Use of digital media expands educators' ability to meet diverse learners' needs beyond what they can achieve with traditional resources. A combination of digital content, the right software, and online tools offers students options for obtaining information and demonstrating understanding. These opportunities help engage each student by providing the right level of challenge for each one.

Chapter 7: Managing Classrooms for Change

Classrooms are complex systems that are affected by many factors. Because they are made up of dynamic human systems, there is no cookbook approach to classroom management or an approach to managing change that works in all situations. If teachers are going to be successful, they need training and hands-on experience with new methods, new technologies, and new ways of looking at effective learning.

Chapter 8: Assessing Instruction and Improvement

To improve student achievement, teachers must set clear standards for students to achieve and identify how students will demonstrate that they have met these standards. Both summative and formative assessments provide data that are important in the learning process, and technology can help educators get the information necessary to gain the full picture of what students know and can do.

Chapter 9: Employing a Sustainable Infrastructure

An infrastructure is the basic physical and organizational structure needed for a program to function. In school districts, it includes computers, software, wired and wireless networks, servers, and other devices that are needed to support the services managed in the data center and the components managed in the cloud, plus the support to keep it all going. As districts develop their educational-technology programs, add companion devices, and move beyond the physical walls of their buildings, they have to plan for the technological infrastructure needed to support these initiatives.

Chapter 10: Trends and Funding

School leaders say that lack of funds is a major barrier to the infusion of educational technology. Current economic realities underscore the point. Educational leaders are charged not only with ensuring students' preparation for high-stakes tests but also with equipping them with the universal skills needed to flourish in a rapidly changing workforce. Schools and districts have struggled to keep initiatives up and running, and trends point to a new day for focusing on and funding educational technology.

Chapter 11: Determining and Evaluating Results

Providing universal access to technology can make a dif-

ference in how students learn and how they approach tasks. Today's schools must provide the learning tools that will engage students and help them achieve both basic and 21st-century skills. Simply providing the tools is only one step. School districts must design a program and implement it wisely and then evaluate the results. This chapter will describe and provide examples of how to determine what to evaluate and how to design an evaluation, as well as measuring results and matching outcomes to goals.

Chapter 12: Conclusion

In planning for e-learning, districts should be strategic in their thinking, which means taking into account all of a district's needs, resources, goals, and priorities before starting any new initiative. This chapter summarizes the key points made in the guidebook. At the end of this chapter is a link to the Buyers' Guide, a separate document on sustaining and growing an e-learning program that will be updated regularly as new technologies emerge and products change.

Sustaining and Growing the Program: A Buyers' Guide

There are various educational-technology solutions available for learning platforms, administrative solutions, and all the tasks needed to run a district. Many offer the best in flexibility, performance, and cost efficiency. Whatever the decision—from desktops to laptops to cloud computing—there are numerous technologies and products for meeting specific requirements. Here are some basics to guide you in choosing the right fit for your school population, curriculum, pedagogical and administrative needs, and IT requirements.

Chapter 1: Understanding Technology for Learning

Technology is everywhere. Practically every gadget we carry around in our pockets, have at home, or encounter in stores, offices, and elsewhere is essentially a computer: a programmable device that receives input, stores and manipulates data, and provides output in a useful format.

Unfortunately, one place where universal access to technology is not universal is in our schools. We see hints of it in one-to-one programs, labs, and blended models, in which students use devices as indispensable tools for learning anytime and anywhere. We certainly see it in some of the companion devices many students carry and use when permitted. Chapter 10 will discuss this "bring your own device (BYOD) model in more detail. This chapter will explore the promises and challenges of technology in learning and related issues to help assess school and district preparedness.

Digital Learning Programs

One-to-one computing programs appeared in K–12 educational programs about 20 years ago. The pioneers of the movement believed that universal access to technology could transform education and dramatically increase achievement. After 20 years, we know that when it's done right, it works well (www.hp.com/go/success).

Realizing the dream of educational-technology programs often requires a fundamental shift in the way we think about learning and teaching. Traditional classrooms function as a shared culture of entrenched patterns that shape beliefs about learning and control the school environment. Changing these fundamental patterns and beliefs in a school's culture is the key to a school's transformation.

For example, the focus on acquiring a standard body of knowledge may no longer be relevant. Because of the exponential growth of information and evolution of thinking, it is an impossible to learn the entire body of knowledge. Almost all data, ideas, and thinking in all intellectual domains are available at the students' fingertips. If acquiring and retaining information are no longer the fundamental goals of the educational system, there are serious implications for our beliefs about learning, teaching, and the role of students, teachers, and schools.

When properly implemented, educational programs with universal access to technology provide a primary building block for new thinking about the process of learning. When students have their own personal, portable computing devices connected to the Internet, they hold the key to their own learning and begin to learn in self-directed ways. Teachers can personalize learning for their students using authentic, student-centered methods. Students can follow their curiosity and work with teachers to produce dynamic project-based content instead of relying on static paper-based curricular materials.

Technology is an important tool but alone will not create reformed schools or prepare students for their future. Transformation occurs only if technology is combined with best practices and used in compelling new ways.

Case Study: Fresno Unified School District

Fresno (California) Unified School District didn't think it could afford to equip all its classrooms in a one-to-one program. School leaders came up with a new solution that cut both the cost and the footprint of technology down to size. It's deploying some 10,000 HP Mini-Note PCs in selected classrooms, giving many students throughout the district a one-to-one or two-to-one student-to-computer experience in the classroom.

The mini notebook is small enough to fit on a student's desk without taking over the desktop and powerful enough to give students and teachers the tools they need to learn and explore. This strikes a good balance with size, price, and capacity for classroom computing.

The district's goal is that over the course of a student's entire K–12 journey, their best work will be digitally saved and gathered in a portfolio. Each student will have a DVD of their finest work, ideas, and school years' history.

Benefits that Fresno Unified is experiencing include:

- The number of computers in selected classrooms increased.
- There was the freedom to pursue individual research projects online.
- Its small footprint allows the mini notebook to share desktop space.
- There is the ability to work collaboratively in classrooms.
- Teachers are able to move from "sage on the stage" to coach/guide/mentor.

Challenges

There are a number of challenges to creating a successful educational-technology program. Funding usually tops this list. Yet Project RED contends that properly implemented one-to-one computing programs can become revenue positive. Information about financing for technology is in Chapter 10.

Advantages

There are endless advantages to learning in a program designed with universal access to technology. Teachers report that the benefits of programs with instructional technology embedded include an increase in students' engagement and motivation, improvements in student-centered activities, and an increase in teachers' and students' use of technology across the curriculum.

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Teachers commonly report in the early stages of technology implementation that their biggest challenges are managing students' off-task use of laptops; the time it takes to learn to use educational technology well; and the time it takes to prepare lessons and activities. Once they are more experienced with the technology and skilled in a student-centered approach to instruction, many of the initial challenges disappear. Classroom-management tools and resources developed over time also contribute to successful implementations.

Another common challenge is when some or all students have no Internet access at home. Even though students may be able to find public Internet access at a local library or community organization, educators often are not comfortable assigning homework that requires access. Teachers can devise a wide range of work-arounds to create optimal learning opportunities, such as group assignments that require only one member to have access to Internet resources. While this is the case in many districts across the country, some innovative districts are finding community and home Internet-access solutions for students and parents. For example, the Alvarado (Texas) Independent School District uses community kiosk programs, and other districts are working with broadband carriers on solutions for providing air cards for students to check out and take home.

Many districts have seen their attendance and graduation rates improve and behavior problems decrease. Students are better prepared for higher education, internships, and the 21st-century global workforce. Project RED's research also indicates that schools with universal access to technology reported:

All Schools

- fewer disciplinary actions
- lower dropout rates
- less paperwork
- lower paper and copying expenses
- greater teacher attendance
- higher test scores

High Schools

- greater AP-course enrollment
- greater college-attendance plans
- higher course-completion rates
- greater simultaneous enrollment
- in high school and college
- higher graduation rates

The Device Is the Tool

Smartphones and handheld devices of many varieties are essential to a mobile learning experience, and education is widely adopting them. These companion devices are generally viewed as secondary to computing devices such as laptops, desktops, and tablet PCs. While PCs are getting smaller, they continue to provide extensive computing power and capacity. Handheld devices are getter richer in applications and functionality, but there are key content-creation uses—multimedia projects, for example—that are best accomplished on PCs.

A variety of other companion devices have emerged. In addition to smartphones, they include e-book readers, tablet and slate devices, graphing calculators, and single-purpose devices. All these remain in the domain of the companion device because they are complementary.

However, the line between a companion device and a primary computing device is blurring as the way we define personal computing evolves. Smartphones are an obvious example in that applications are available that make it easier to use smartphones to find information and connect to communities of users in innovative ways. The smartphone or tablet device is now the primary computing device for many while they are mobile. When people stop moving, whether that be in an office or a coffee shop or at home, they still tend to shift back to their wirelessly enabled laptop or desktop computer.

Whether the future will be with a laptop, netbook, smartphone, tablet, slate, or some other, future device, it is becoming clear that there will be roles for both primary and companion computing devices.

What the Research Says About the Success of Technology Integration

Researchers report that integrating technology affects students' motivation, autonomy, access to diverse sources of information, development of technology skills, and engagement. These are all important aspects of the learner's experience that can lead to academic success. But does technology integration lead to greater academic achievement?

The answer is that it depends. It depends on whether the technology is implemented in a way that changes the behavior of teachers and students so that it leads to increased academic achievement. Simply employing technology in the classroom does not necessary change the way that teachers teach and students learn.

Papanastasiou, Zemblyas, and Vrasidas support this idea with their finding that computer use in and of itself does not have a positive or negative effect on student achievement (2003). It is the way technology is used that makes the difference.

Dr. James Marshall at San Diego State University reviewed existing research on the impact of technology on learning and found clear evidence that educational technology "complements what a great teacher does naturally." He says, "With ever-expanding content and technology choices, from video to multimedia to the Internet, there's an unprecedented need to understand the recipe for success, which involves the learner, the teacher, the content, and the environment in which technology is used."

This kind of complex system will not change overnight. When teachers have the time to experiment and grow in the ways they use technology in instruction, programs become more efficient and students are more engaged. Achievement will ultimately improve, but these improvements may take a few years to come to fruition. The process requires a mindful, systemic change-management strategy.

Project RED: Key Findings

Project RED, a partnership among the One-to-One Institute (OTO), the Greaves Group, the Hayes Connection, and Peterson Public Sector Consulting, was created to identify the key implementation factors that lead to academically successful and financially sustainable educational-technology programs. The research investigated three hypotheses:

1. Properly implemented educational technology can substantially improve student achievement.
2. Properly implemented educational technology can be revenue positive at all levels—federal, state, and local.
3. Continuous access to a computing device for every student leads to increased academic achievement and financial benefits, especially when technology is properly implemented.

From the One-to-One Institute's research, nine key implementation factors emerged as being most strongly tied to a program's success.

Key Implementation Factors

1. Intervention classes (e.g., Title 1, reading recovery, special education): Technology is integrated into every class period.
2. Change-management leadership by principal: Leaders provide time for teachers' professional learning and collaboration at least monthly.
3. Online collaboration: Students use technology daily for online collaboration (games/simulations and social media).
4. Core subjects:Technology is integrated into core curriculum weekly or more frequently.
5. Online formative assessments:Assessments are done at least weekly.
6. Student-computer ratio:Lower ratios improve outcomes.
7. Virtual field trips: With more frequent use, virtual trips are more powerful. The best schools do these at least monthly.
8. Search engines:Students use daily.
9. Principal training: Principals are trained in teacher buy-in, best practices, and technology-transformed learning.

As the researchers analyzed the data, it became clear that schools really are inconsistent in technology implementation. Although each key implementation factor may have a significant positive impact, they did not find any schools nationally that were implementing all the factors, and very few that were even implementing most of them.

The Project RED data also provided substantial evidence that technology can have a positive financial impact. Making the investment in technology alone, however, is not enough. To realize the financial benefit of the investment, schools have to embrace what the researchers call second-order change and completely reengineer the way schooling is done.

A second-order change is very different from most of the changes or innovations in education we have seen. Instead of improving the current system, a second-order change alters the system itself. In the report, *The Technology Factor: 9 Keys to Student Achievement and Cost Effectiveness,* the authors describe it as:

"When the Pony Express introduced faster horses, better horse feed, and lighter-weight papers, the incremental improvements in speed constituted a first-order change. Then mail delivery by train provided a second-order change."

While a one-to-one student-to-computer ratio seems to increase the impact on student outcomes, a third key finding, and one that is important, is that technology-based schools employing the key implementation factors outperform all other schools, including one-to-one schools that do not embrace the key implementation factors.

Assessing Your District's Digital Learning Environment

Understanding the strengths and weaknesses of a district's technology environment is an essential step to ensuring a program's long-term success and sustainability.

There are several key components to assess.

- leadership and the effectiveness of the transformative strategies
- the development of the district's goals and execution of its strategic plans
- what is actually happening in every classroom and with every student
- the overall effectiveness of the technology program

Leadership

Assessing leadership and the effectiveness of strategic plans is valuable.

Shared vision drives the program. While a strong leader—superintendent, technology director, or building principal—can drive the initial thinking through his or her passion and leadership, a leader must collaborate with others to create a vision that all share, that lives in the hearts and minds of all the program's stakeholders.

Creating the shared vision begins by engaging all the stakeholder groups in the development process and in the ongoing management of the program. Chapter 2 will explain more about a shared vision, but here are some initial questions to help assess where a district is:

- Does the district have a technology leadership committee?
- Does the committee include central office leaders, building leaders, district technology leaders, teacher leaders, and community leaders and possibly even student leaders?

- Is the committee empowered to make decisions about the implementation of the program?

Educational-technology programs require a major shift in the way teachers and schools function. School leaders have to understand what this change looks like and be trained to guide their staffs in this transformation.

They must also understand that this pedagogical shift can be difficult for some teachers and that it will take time to transform the learning environment. The school leaders should cultivate an environment of innovation. In this environment, teachers and students are encouraged to be creative, take calculated risks, and learn from the experience.

Districts can consider the following questions:

- When do we expect to see a shift in the classroom practice of all the teachers?
- Do we have realistic benchmarks and timelines for teachers?
- Are we supplying enough time, training, and support for teachers to be successful?
- Are mistakes seen as tools necessary for learning, or are teachers punished for classroom innovations that fail?

In a digital learning environment, technology is seemingly invisible. Technology is everywhere, and students use it seamlessly without thinking about it, and there may be a variety of computing devices for students to use.

Strategic Planning

An educational-technology program's strategic plan includes goals and objectives and plans for communication, finances, hardware and infrastructure, professional learning, assessment, and capacity building. It must also include benchmarking and implementation timelines. Using project-management software, such as a Gantt chart, can help in assigning responsibilities, tracking progress, and working toward goals. There is more detail about these in later chapters, but here are a few initial questions to consider:

- Do we have specific written plans for each one of the components of the strategic plan described above (communication, financial, hardware and infrastructure, professional learning, assessment, and capacity building)?
- Are our benchmarks and timelines realistic, and are they clearly aligned with the goals and objectives of our plans?
- Have we developed a financial plan of at least five years' duration to fund the technology through the first device-refresh cycle?
- Do we have a hardware and infrastructure plan that is flexible and allows for changes in technology and the growth of the program?
- Do we provide regularly scheduled time for teachers to engage in professional learning, as well as plan for instruction and collaborate with their colleagues?
- Do we have assessments that provide us with data about individual components of the program, teacher effectiveness, and student achievement?

Program Evaluation

Evaluating the program is essential, and having an outside independent evaluator is a good way to get credible data that you can use to support the program's impact and to help in future decision making. Chapter 7 and Chapter 11, respectively, will address assessing instruction and evaluating the success of a program. The questions below can help a district decide if it is on the right track.

Please note that the One-to-One Institute has found that it makes a difference if each student has their own device and uses it all day. There are many configurations, but when students feel ownership, they treat devices differently and have a different level of engagement.

- Does each student have his or her own mobile computing device with continuous Internet access?
- Are there enough access points to ensure wireless connectivity for all students everywhere in the learning space at the same time?
- Do students use the same device all day?
- Are there enough replacement devices available

for students who are having their devices repaired?
- Is there a technical-support person in each building?
- Do teachers have access to a help desk and other support?
- Is there enough reliable tech support to quickly address concerns and fix problems?
- Does each teacher have a mobile device?
- Are there enough charging stations in the learning environment to charge all the devices at the same time?
- Is there a plan of action for when devices are not charged?
- Is there accidental-damage and security for all the devices?
- Is the bandwidth sufficient to handle all the devices logged on at the same time?
- Is there sufficient server space to handle the capacity of the program?
- Does each student and staff member have a unique username and password?
- Does each student and teacher have their own folder on the network server?
- Is an acceptable-use policy in place?

Evaluation of Instruction

The transition from a teacher-centered environment to one that is student-centered, personalized, and infused with technology is not always easy. Students who are used to being passive recipients of information and teachers who are used to always being in charge may find it challenging to make this shift. The questions below review some of the more basic technology-transformed classroom elements and may help you determine if you are on the right track.

- Is technology integrated into instruction in all our core academic classes every day?
- Is technology integrated into all our intervention classes every day (e.g., Title 1, reading recovery, special education)?
- Does our school allow students to collaborate with each other via social media?
- Do students regularly use blogs, wikis, and other online collaborative tools?
- Is technology used to personalize our students' learning experience?

What Does Success Look Like?

We have discussed many of the key components of successful digital learning environments. What does this actually look like in the classroom? Below are descriptions of what students, teachers, and the learning environment might look like.

Students

Students are working independently and in small groups on a variety of assignments and projects. The noise level may be higher than is common in most schools today. As you listen more closely to the noise, however, you notice that the sound is being generated by a flurry of intellectual activity. Students are debating with each other about the meaning of the content. A group of students in the corner are conducting an experiment and collecting data. Two other small groups are deciding on music and images for the video they are going to use to explain what they have learned.

Teachers

The role of teacher in a personalized, student-centered, digital learning environment changes dramatically from what it is in the traditional classroom. Orchestrating the environment, the variety of assignments, the diverse work products, and the personalization of instruction requires a great deal of skill and planning. Teachers report, however, that the advantages outweigh the extra time and effort that they put in at the beginning of the rollout. Once programs mature, many teachers begin to report significant productivity efficiencies. Again, the advantage for teachers who take on this challenge is the freedom it provides during the class period. Teachers become available to work with individual students who are struggling and also provide just-in-time instruction to groups of students who have to learn something new or relearn a concept to achieve their goals. The teacher becomes, in effect, a facilitator of learning and a resource during the class period that students can use to help them achieve their goals.

The first impression in this classroom may be that the teacher has lost control. However, looking deeper at what students are doing and how they are interacting shows the underlying structure and reveals that students know what is expected of them. There is an energy and a flow in the

classroom that is not happening by chance. Although there are a number of things going on in the classroom, the furniture, hardware, and all the other resources seem flexible and appropriate for the work the students are doing.

Environment

In a digital learning environment, technology is seemingly invisible. Technology is everywhere, and students use it seamlessly without thinking about it, and there may be a variety of computing devices for students to use. Each student has his or her own primary device for accessing the Internet through the wireless network. There are a couple of high-powered desktop computers with large monitors that students can use for such technology-intensive tasks as mixing a sound file and embedding it in a high-definition video before working on their edited master. Other students are using science probes to check the pH level in the water of the fish tank and send the data from their handheld devices to a spreadsheet on their wireless laptops. Still other students are texting their responses to a survey the teacher posted at the beginning of the class.

The teacher uses a classroom management system (CMS) or learning management system (LMS) not only to monitor students online but also to organize all the instruction, house important resources, and provide a platform on which students can collaborate. The teacher's grade book, calendar, homework assignments, rubrics, assessments, and a host of collaboration tools are bound together to create a dynamic online learning community that is accessible anytime and anywhere. The teacher uses this online environment to extend instruction beyond the classroom and beyond the school day.

The environment is designed for all types of learning: It has spaces for group work, hands-on activity, presentations, and lectures as well as spaces where students can work in more independent traditional ways.

How Do You Know You Are Moving Toward Your Goals?

Creating successful digital learning programs is a process, not an event. If a school shows evidence of many of the characteristics of successful programs discussed in this chapter, it is probably moving in a positive direction, toward its goals. It is important, however, to articulate specific goals and objectives to achieve the vision and meet the expectations planners set for the program.

District leaders must also understand that change happens over time. Teachers will grow and change at different rates. Early adopters may embrace new ideas quickly and immediately use them in the classroom. Others may take several years to transform their classroom environment and the way they teach. Although everyone is working toward the same long-term goals, the instructional leaders must be aware that different support may be needed to address the varied learning needs of the entire staff.

An example of how articulating specific goals and objectives is handled is Auburn (Alabama) City Schools. The mission of Auburn's 21st Century Learn-

ing Initiative is to "prepare 21st-century students and educators to be contributing members of an ever-increasing technological and global society through an anytime, anywhere learning environment." The district developed three goals that it believes will achieve this mission.

Table 1 shows how one of these goals was defined before the program was implemented and the specific elements that must be detailed to achieve the goal.

Finally, creating an environment of continuous improvement will keep a program on track for years. Continuous learning and growing are important for everyone from students to teachers to administrators and even custodians. Formal professional-learning opportunities should be regularly scheduled, but less formal opportunities to collaborate and learn from each other should be ongoing. A "cycle of improvement" should be in place. The parts of the cycle include:

- Learn something new.
- Have an opportunity to try it in a real-world setting.
- Have the opportunity to discuss with colleagues how it went.
- Plan to try it again according to the feedback.
- Try it again in the real-world setting.
- Repeat the cycle.

If schools follow these suggestions, they will begin to see the change necessary to move the educational system forward. It is not always easy, but if leaders at each level of the educational ecosystem are committed to changing, learning, and improving, great things can happen.

Table 1: How Auburn City Schools defined one of their goals before implementing the program

Goal: Teachers will change and improve the delivery of instruction to realize the benefits of a one-to-one computing environment.					
Objective: To infuse curriculum, instructional methods, content, projects, and lessons with 21st-century educational technology throughout the daily delivery of classroom instruction					
Activities that help achieve the objective and outcome	**Inputs** that help achieve the objective and outcome	**Data**	**Measurement**	**Outcome** (what was accomplished)	**Timeline**
Create and facilitate growth of self-directed and viral learning communities (e.g., Wikipedia) to support independent learning, information gathering and exchange, and communication	Sandbox space on the Internet for new kinds of communication exchanges and new on-line communities that meet safety and quality requirements	Direct comparison of curriculum, instructional methods, content, projects, and lessons to record the quantitative and qualitative differences as well as differences in kind	Observable differences in curriculum, instructional methods, content, projects, and lessons		

Summary

This chapter addressed the following components of understanding how to implement an e-learning environment:

- The "why" for educational technology
  - Universal-skill development
  - An effective workforce
    - Student engagement
  - A look at the research
    - Key implementation factors
- The significance of planning
  - Elements of effective planning
  - Essential readiness questions

Checklist

The following checklist is an inventory of actions and activities to help schools and districts understand what is involved in creating an e-learning environment:

☑Definition of educational-technology implementation

- Beyond one laptop per student
  - Goals to be achieved using which hardware and software
  - Continuous access for each student
  - Internet, digital resources, electronic materials, etc.
  - Tied to achievement, productivity, and financial outcomes

☑**Identification of research to support theplan**

- Effectiveness in reaching educational, economic, citizenry, workforce goals
- Proper implementation
- Professional-learning requirements and outcomes
- Required leadership skills

☑**Assessing the digital learning environment**

- Leadership
  - Administrators
  - Teachers
  - School board
  - Community

☑**Shared vision**

- Engagement of all stakeholders
  - Teachers
  - Administrators
  - Community and business-community members
  - Students
  - Parents/caregivers
  - Support staff

☑**Strategic action plan**

- Project manager
- Steering committee
  - Regularly scheduled meetings
- Action plans tied to benchmarked goals
- Use of project-planning software, e.g., Gantt charts for tracking and accountability
- Delineate expected outcomes, goal setting
- Students

Chapter 2: Planning for E-learning

Implementing an educational-technology program means advance planning and careful preparation. Planning is a complex and detailed process that is tied to the organization, culture, and personnel involved, and there are no shortcuts. To achieve goals and sustain a robust program, school districts have to lay the groundwork and engage all stakeholders in setting expectations, making decisions, establishing benchmarks and timelines, and achieving consensus.

School district administrators should take two initial steps. The first is to choose a project manager who is organized, efficient, and fastidious about benchmarking and accountability. The second is to decide which tools the manager will use. While there are many tool kits school leaders can use to guide the planning process, all include similar elements.

To deal with the complexity of large projects, a district can use project-management software that incorporates the following: scheduling, cost control and budget management, resource allocation, collaboration, a communications system, quality management, and documentation. The software can be server- or Web-based and should be collaborative.

Using project-management tools helps a district set the process in motion and move toward setting goals, benchmarks, and timelines; identifying problems, solutions, and adjustments; and determining assessments. It helps ensure that the manager establishes active communication with stakeholders, the school board, and the community.

Shared Vision

Once district leaders have decided to move forward with an educational-technology program, everyone must agree on the vision, the "why": the reason we are doing this. The costs, in terms of financial and personnel commitments, are great, and a superintendent must promise that the result will be what everyone has agreed on. Yet getting to this agreement is also a process, and the first step is to identify the stakeholders who will decide on the goals and anticipated outcomes of the program. Communication among participants leads them to agree on what they want and then express that vision to the rest of the school community.

Identifying key stakeholders for a task force is a big step. The task force usually includes representatives from stakeholder groups, such as board members, administrators, teachers, students, parents/caregivers, and business and community leaders. It can include state-level policy makers as well.

Task Force and Action Plans

The task force creates a vision that its representative groups sign on to. The vision includes setting project goals according to a needs assessment and supporting research: evidence of how the program will transform education and increase students' success. Task-force members must report back to their respective stakeholder groups about decisions and answer questions about the program's purpose, risks, and short- and long-term strategies.

A task force should be small enough to get work done but also represent key groups. It should include the project manager and representatives from the principals, teachers, curriculum and technology personnel (instruction and infrastructure), support staff, business community, and parents/caregivers, with ad hoc involvement of the superintendent and the board. While the opinions of those who will have significant roles in development and implementation are important, the diverse opinions and experiences of all task-force members can help drive the project in productive ways.

In addition, members can get advice by networking with a community of peers with similar goals, share best practices, read case studies, and network with colleagues who have already implemented successful programs and those who are at a similar stage of implementation. In addition to communicating with their respective groups, members can consult with vendors for their expertise and partnerships to estimate the project's costs.

Needs Assessment and Gap Analysis

To determine next steps, the task force must first decide why it wants to implement an educational-technology program. This analysis should focus on needs and resources for student achievement, research, and best practices; note areas that need improvement; capitalize on new strategies that can come from changes in methods and technology; and evaluate local policies, funding sources, and flexibility.

At its core the program will have people, processes, technology, and data. It is important to do a gap analysis to determine if each core area has the capacity to deliver its component to ensure a successful program. The committee can pose questions such as:

1. Are the right people in the right positions to support the program's success? Which additional skill sets are needed to integrate the new technology and data-driven decision-making solutions? Provide training for all skill levels.
2. Are the school's/district's processes helpful or a hindrance to what is to be accomplished?
3. Which technologies exist where?
4. What is the refresh cycle?
5. How is the refresh cycle being used and by whom?
6. Is the infrastructure able to accommodate the program and the number of participants now and in the future?
7. Are there sufficient electrical outlets?

Case Study: Alvarado Independent School District

The value of a one-to-one technology program, in which every student is guaranteed access to his or her own computer in the classroom, has been proven over and over in recent years. But in many economically disadvantaged school districts, the promise has remained out of reach because of lack of funding.

The HP Mini PC has helped extend the reach of the Alvarado (Texas) Independent School District. District leaders found that the budget would enable them to purchase a Mini PC for every fifth and sixth grader. The vision of implementing technology one-to-one became a reality.

Preparing for one-to-one: The district built toward the first one-to-one technology deployment slowly. It was several years before it was able to deploy PCs to students; it first worked to plan teacher training and ensure a capable infrastructure and technology-support systems.

Alvarado ISD recognized that there is much more to good implementation than simply putting a PC in a student's hands and hoping to get expected results.

8. What will be the processes for recharging and storage?
9. What data is collected that helps create measurement criteria and determine program benchmarking?

Action Plans

Once the task force has conducted a needs assessment and gap analysis, its members can look at the district's objectives to determine short- and long-term project goals and timelines. They have to align student-achievement goals with curriculum, instruction, and technology standards. Then they can determine and assign specific tasks, benchmarks, and timelines. The main task force and task-oriented subgroups should meet regularly to discuss and solve problems, monitor progress, adjust goals or timelines, provide updates to constituent groups, and seek additional support when needed.

Actionable steps should be aligned with short- and long-term goals and assigned to specific personnel, who must follow timelines or communicate reasons for timing adjustments. The identification process includes:

- determining groups' and individuals' readiness for robust technology integration and assigning development of professional-learning activities.
- mapping curriculum standards with technology-integration expectations
- aligning and communicating about policies and procedures
- defining how each stakeholder's role and responsibility will change to accommodate the transformation
- assessing human resources and technology infrastructures to determine the capacity of the transformation to be successful

Using a phase-in approach is a way to achieve the overall desired scale, and action plans for a number of states and districts have included small proofs of concept. The small settings provide an opportunity to monitor, support, and adjust through ongoing formative assessments of the program and students' progress. Lessons learned over a defined period help adjust future program expansion. It is easier to make the changes required for day-to-day success in a small pilot program than in a larger one. However, there is much evidence that using a single classroom as proof of concept is not broad enough to show return on investment and determine best practices. At least two classrooms are recommended as a starting point for a proof of concept.

A key professional-learning activity for teachers is mapping curriculum standards and benchmarks for technology integration, a process that takes time and collaboration. Teachers will use the technology not just for the sake of using it but will integrate technology into the instructional program where it is relevant and applicable. Understanding where technology can be used well requires a significant transformation of pedagogy, higher-order skill development, and time and practice. While most of today's teachers were taught in teacher-centric classrooms, technology use will drive today's classrooms into a learner-centric model.

> **At its core the program will have people, processes, technology, and data. It is important to do a gap analysis to determine if each core area has the capacity to deliver its component to ensure a successful program.**

In addition to the above, the following are major components of a strategic action plan:

Ensure teacher buy-in:

- Systemic change begins in the classroom, and teachers are key. They need a voice, ongoing input, and opportunity for feedback. They will integrate technology and change teaching methods based on readiness, attitude, and aptitude. Principals should support teachers through open and ongoing discussions to help them understand and move forward with the transformation.

Establish consistent, ongoing professional learning for all:

- Professional learning should make change coherent and relevant for meaningful technology integration and overall educational transformation. Ongoing professional-growth activities and personal-learning networks are necessary and include the kind of coaching and mentoring frame-

work that differentiates for the adult learner.

Develop a consistent communication plan:

- Ongoing communication with stakeholder groups is essential. Each person with responsibility for communication should provide accurate, updated, and honest information and report on both successes and pitfalls, which will lead the community to embrace and engage with the program.
- Social networks, Web 2.0 tools (e.g., online user groups, learning communities, wikis, collaborative documents, blogs) can become standard means of communicating, modeling the expectation that the school community will become adept in the use of technology and benefit from its efficiencies.

Engage an outside program evaluator:

- Planners should determine specific criteria for success that are related to the project's goals, and the best way to ensure an objective program assessment is to hire a third-party evaluator who can align assessment with the project's goals. Publicly reporting the findings is important to the program's success and accountability.

Create sustainable program plans:

- Determining short- and long-term program funding is critical to planning in this era of declining education budgets, and relying on internal resources is important for building long-term capacity. School leaders should examine existing expenditures and the return on those investments. They can often find legacy expenditures that are inefficient and outdated and that they can use to support short- and long-term budgets for the technology-integration program.

Identify procurement policies and processes for the program:

- Most organizations have in place policies and procedures for technology purchases and use. Leaders can examine the current language to ensure security, infrastructure, and other requirements for success. If adjustments are needed, time is also needed, for review and adoption by legal and the board.
- An orientation process will help all involved understand the program and the power and commitments that accompany use and/or ownership of the technology. They will sign contracts that identify policies, practices, and expectations for and consequences of use/misuse, damage, and other factors. Chapter 3 addresses policies and procedures in greater detail.
- School leaders must enforce the policies for parents, students, and teachers, and not upholding these policies must have consequences.

It is clear that change without technology is not real change and that advances to meet future needs will depend on using technology in creative new ways. Understanding all the facets of what matters and how to plan for it is critical in forging new outcomes for all learners.

Generate policies that guide the program and inform participants:

- Security and acceptable-use policies will guide participants in all aspects of the use of technologies and must include parents/caregivers, students, educators, and support staff. The purpose is to safeguard expensive equipment, ensure students' safety online and with their devices, and communicate the value of and expectations for involvement with the program.

The National Education Technology Plan 2010 says, "Transforming U.S. education is no small task, and accomplishing it will take leadership throughout our education system—states, districts, schools, and the federal government—as well as partnerships with higher-education institutions, private enterprises, and not-for-profit entities.

"Building capacity for transformation also will require investment. But we must resolve to spend investment dollars wisely, with clear expectations about what we expect in terms of learning outcomes and process improvements...As we enter the second decade of the 21st century, there has never been a more pressing need to transform American education, and there will never be a better time to act."

Education in the U.S. is primarily a state and local responsibility, and leaders at all levels have a serious challenge ahead. Yet it is clear that change without technology is not real change and that advances to meet future needs will depend on using technology in creative new ways. Understanding all the facets of what matters and how to plan for it is critical in forging new outcomes for all learners.

Summary

This chapter addressed the following essential components in planning an e-learning environment:

- Components of effective e-learning environment planning:
  - leadership
  - vision
  - elements of strategic action planning

Checklist

The following checklist is an inventory of important action and activities for planning an e-learning environment:

☑**Understand the current digital learning environment.**

- leadership
  - administrators
  - teachers
  - school board
  - community
- shared vision
- engagement and buy-in of all stakeholders
  - teachers
  - administrators
  - community and business community
  - students
  - parents/caregivers
  - support staff

☑**Define strategic action plan.**

- project manager
- task force
  - representation from each stakeholder group
  - needs assessment and gap analysis
    - people
    - processes
    - technology
    - data
  - regularly scheduled meetings

☑**Ensure that action plans are tied to benchmarked goals.**

- short- and long-term
  - Use project-planning software, e.g., Gantt charts for tracking and accountability.
  - Define policies and procedures to guide implementation and practices.
  - Delineate expected outcomes; set goals.
    - students
    - teachers
      - mapping of curriculum and standards to technology integration
      - ongoing determination of and experimentation with best practices
    - timelines
  - teaching and learning environment
    - physical
    - pedagogy
    - platforms
  - communication plans
    - internal
    - external
    - use of social media
    - on-point, consistent messaging
    - honest

☑**Establish professional learning for all stakeholders.**

- built into the life of the organization
- regularly scheduled
- organic, just-in-time component
- coaching/mentoring framework
- communities of practice

☑**Arrange for program evaluation.**

- external, third-party, reputable organization

☑**Create sustainability plans.**

- financial
- human resources
- redundancy practices
- procurement policies and practices

Chapter 3: Establishing Policies and Procedures

State and local governments as well as school districts determine policies regarding such issues as the mission of education, social and academic objectives, methods of attaining goals, and the tools for measuring whether and to what extent those goals have been achieved. Use of technology for learning and data is an area that has driven much recent conversation about policy.

Policy is defined as a principle or rule that drives decision making and practice. Policies and procedures enable districts to carry out their plans. Technology policies are important drivers of practice, expectations, and stakeholders' behavior. The key question for governing bodies is not whether the benefits of technology outweigh the costs (research and best practices bear this out) but how to implement programs to ensure effectiveness and results.

The National Education Technology Plan 2010 encourages educators to be clear about outcomes; collaborate to redesign structures and processes for effectiveness, efficiency, and flexibility; monitor and measure performance; and be accountable for progress and results.

Since the first large-scale educational-technology programs began, in the 1990s, technology prices have

dropped, low-cost device options have become universal, the Internet has become pervasive, e-operations have emerged as the increasingly standard form of service and communication, and digital resources have enhanced capacities. Policy makers and policies must be nimble enough to reflect these transformations.

While educators are central to the success of any program, effective federal, state, and local policies provide the broader context that shapes and drives instructional technology in schools. Policy provides the foundation that powers planning. Useful policies are flexible, reviewed regularly, and adjusted to bring about authentic transformation.

Policy developers can apply a systematic approach in order to set clear, realistic expectations for sensible time frames and focus on goals and evaluations that can help determine the effects of policies. The test of successful policies is examining a program's accomplishments to determine whether intended beneficiaries are profiting, if the results are fair, and what the effects on all stakeholders are.

Communication about policies is crucial to success. Leaders can create a strong marketing campaign to create awareness, ensure buy-in, and build a wide political consensus behind the program. Likewise, they can create a strong communication plan to quantify results and impact.

Policy makers must ensure that the people affected by the policy understand the plan, expectations, and benefits. They should stress that the focus is education, not equipment, and incorporate training for administrators, teachers, students, parents/caregivers, and all those touched by the policy and the program.

The focus is education, not equipment. Policy makers should incorporate training for administrators, teachers, students, parents/caregivers, and all those touched by the policy and the program.

Federal, State, and Local Policies

Federal, state, and local policies provide the context in which all education takes place. Effective policy builds a foundation for district, school, and classroom innovation. Understanding the elements of effective policy making is crucial for educational leaders.

Federal Policy

Federal policy, such as No Child Left Behind, often tries to accomplish goals that depend on the resources and efforts of state and local governments and hold those governments accountable for expectations of the policy. Understanding the underpinnings of policy can guide state and local leaders in designing implementation plans. National organizations, such as the State Education Technology Directors Association (SETDA), the Consortium for School Networking (CoSN), the Partnership for 21st Century Skills (P21), and the International Society for Technology in Education (ISTE), provide guidance to policy makers regarding best practices, needs, and research that inform the requirement for targeted funds for educational technologies.

Federal goals for higher performance may collide with state and local governing structures, practices, and budgets but have the potential to transform educational policy. Many variables influence the impact of federal policy over time.

Filtering Policies

In 2000, Congress enacted the Children's Internet Protection Act (CIPA) as part of the Consolidated Appropriations Act. The act provides for three types of funding: (1) aid to elementary and secondary schools; (2) Library Services and Technology Act (LSTA) grants to states for public libraries; and (3) the E-Rate program, which provides technology discounts to schools and public libraries.

CIPA requires public libraries that participate in the LSTA and E-Rate programs to certify that they are using computer-filtering software to prevent the on-screen depiction of material harmful to minors. The act allows adult library patrons to request that a librarian disable the filtering software. In order to receive E-Rate discounts, libraries are not allowed to disable filtering programs for minor users. The Federal Communications Commission Web site (www.fcc.gov/cgb/consumerfacts/cipa.html)

provides background information about the Children's Internet Protection Act.

Many states have Internet filtering laws that apply to public schools and libraries. Most require school boards and public libraries to adopt Internet-use policies to prevent minors from gaining access to obscene or harmful materials. Some states require publicly funded institutions to install filtering software on library terminals and school computers. Yet just as we teach our children to look both ways before they cross the street, we must teach students safe online behavior so they can function in a society in which many transactions happen online, where they will not be filtered.

Examples of State Policy

Anita G. Givens, then senior state technology director of the Education Technology Division of the Texas Education Agency, developed the Texas Technology Immersion Pilot (TIP), an example of policy that creates systemic school integration.

Funded by leveraged Title II, Part D (NCLB) federal technology monies, TIP affords schools in Texas the chance to apply for competitive grants that will cover the cost of providing all teachers, administrators, and students within the school access to six elements of total technology immersion:

- wireless mobile computers with Internet access
- productivity software
- online-learning software
- formative-assessment software
- professional development
- technical support

Previously, public schools were required to use their state textbook allotments to purchase hard-copy textbooks for all their students. Legislators received input from stakeholders throughout the state and developed House Bill 4294, which allows local districts to decide for themselves how much of their state textbook allotment to use toward digital materials and technology, offering them a choice regarding the technologies and instructional materials they purchase. These former "textbook-only" funds can also be used to purchase the hardware required to gain access to the new digital resources.

Provisions of the bill allow the use of the state textbook fund in purchasing equipment needed to support the use of electronic textbooks or digital instructional materials that are included on the adoption list. For more information, visit www.legis.state.tx.us.

State Examples

Indiana

The Indiana Department of Education is endeavoring to learn about existing and future products and services in the area of digital content and curriculum. Leaders want to move from print to digital resource in an overarching transformation. The Indiana Department of Education and the Indiana State Board of Education have given the state's schools expansive flexibility in the areas of instructional materials and textbook adoption. They have expanded the definition of textbooks to include computing devices. This elasticity creates opportunities for innovation and has catapulted schools into opportunities for reform.

Florida

Florida is moving to expand virtual-learning options for all students. The basic goal is to give all Florida students as many good online educational options as possible regardless of where they live or attend school. State leaders are working to bring consistency to the qualifications, funding, and accountability for all public and private providers.

The Florida plan includes allowing every student in grades K–12, with no preconditions, access to all state-approved virtual-learning providers whether full- or part-time. These virtual programs would receive the same level of state funding (www.redefinedonline.org/wp-content/uploads/2011/02/Virtual-Education-Group-Report-2-2-11.pdf).

Georgia

Putting Race to the Top funds to good use, Georgia made a strong effort to involve a broad stakeholder group in its application process. Teachers, business leaders, and legislators were included and supported by the governor's office. A focus on student achievement and the inclusion of a wide range of interest groups in connection with reform objectives won the state its award. An overarching goal is that students will achieve a year's learning in a year's time.

Data are at the heart of Georgia's educational-reform efforts. They include everything from decision making to assessing teachers' effectiveness. More data translate to more effort on the part of CIOs. They also make the CIOs front and center in the success of the reform effort, which is a great opportunity.

Delaware

With Race to the Top as inspiration and, later, as award, Delaware created Vision 2015. State leaders demonstrated an unprecedented commitment to focusing on ensuring a good education for every state learner by 2015. They agreed that the central question, going forward, for all policies and actions must be: How can we best tailor learning so that each student succeeds? Because students are at the center, the main changes must occur closest to the student: in schools and classrooms. The following are the six tenets of the state leaders' RTTT strategies.

1. *Set high standards, develop a common curriculum.* This includes:
   - academic standards as challenging as the world's best
   - a statewide research-based curriculum so that all Delaware students, no matter where they live, are using the same high standards
   - aligned content-specific teaching tools (diagnostic assessments, model lessons, pacing guides) and classroom-based professional coaching to help teachers meet each student's learning needs
   - assessments that measure individual students' gains over time
   - state funding for an additional 140 school hours a year for extra tutoring and/or enrichment, depending on what the student needs
   - implementing the state's stronger graduation requirements
   - expanded online distance learning to allow true 24/7 learning opportunities
2. *Invest in early-childhood education.*
3. *Develop and support high-quality teachers.*
4. *Empower principals to lead their schools. This includes:*
   - broader principal control of decision making related to people, resources, and time
   - increased accountability for students' achievement and schools' performance
   - the flexibility to choose from among approved providers of educational services
   - a statewide leadership academy for recruiting, inducting, retaining, and developing world-class principals
   - a statewide base salary schedule with significant bonuses tied to student achievement
   - more-easily-accessible data on student performance, staffing, and finances to help principals make better decisions
5. *Encourage innovation and parent involvement; require accountability.*
6. *Establish a simple and equitable funding system.*

Acceptable Use Policies

Much has changed in the educational landscape since districts began writing acceptable-use policies (AUPs), and policy revisions reflect these changes. According to David Warlick's Landmark Project Web site AUP 2.0, school technology-use policies should:

- promote the most effective, productive, and instructionally sound uses of digital, networked, and abundant information in learning environments
- provide safe digital environments for learners and to instill safe practices and habits among the learning community

Given the need to adjust for the times, these considerations are also posted on the AUP 2.0 site, http://landmark-project.com/aup20/pmwiki.php:

- Define and describe the reasons your school or school district is facilitating access to digital, networked, and abundant content. Describe the instructional and management benefits and the reason why the information infrastructure is critical to the mission of your school or district.
- Describe the benefits-aligned practices and applications that are being provided for and encouraged, and who can utilize them.
- Describe conditions for experimenting and evaluating practices and applications not identified in the document.
- Define and describe broader information-ethics issues within the context of the school's/district's information infra-

structure, including but not limited to: copyright, information integration, and respect for the infrastructure.
- Describe the information infrastructure of the school or district, including hardware, software, and support staffing.
- Define and describe practices and applications that are prohibited by the administration and the consequences of using the information infrastructure in these ways.
- Define and describe technical and procedural practices that will be applied to the information infrastructure to monitor and restrict use and abuse.
- Provide support materials or access to support materials to assist faculty, staff, and students in learning to make appropriate, productive, and safe use of the information infrastructure.

The significance of policy goes beyond the initial development of the planned systemic change. Particularly at the district and school levels, strong leaders will see the necessity for a policy that addresses dos and don'ts of technology use and will create acceptable-use policies as a foundation for all members of the school community involved in using the technology. Some believe that there should be a safety and security curriculum in addition to a policy so that students and others understand not just what is important regarding Internet use and safety but why it is important.

Recommendations for Students' Online Safety:

Kim Comando, who writes the CyberSpeak column in *USA Today,* compiled instructions that districts commonly use. These include:

1. *Never* give out personal information without parents'/caregivers' permission.
2. Anyone can post anything to a Web site. Review Web sites carefully. Teachers must help students with this process.
3. It is important to cite sources when copying information from a Web site or other electronic resources. When you copy information from a Web site or other electronic resources, you *must* cite the source, or it is plagiarizing. If you do copy and paste information, put it in quotation marks and list the source from which you obtained it.
4. When you copy pictures, video, or sound clips, you must also cite the source from which you obtained them.
5. Do not play games, send instant messages, or access inappropriate Web sites during school. Remember that the laptop is a tool for learning. If you choose to do any of these things, you are jeopardizing the laptop program and your integrity. There will be consequences as established by the Walled Lake Schools Student Code of Conduct.
6. The district has a filter to prevent you from accessing inappropriate Web sites. People who post pornographic images or who are involved in hate groups often find ways to get around filters. If you accidentally stumble upon an inappropriate Web site, quickly exit, close your lid, and tell your teacher. *Do not* show your classmates what happened or discuss it with them. Be sure to follow this procedure.
7. Do not use file-sharing services. These sites allow strangers from all over the world to share files. They can be used to download movies, TV shows, music, software, and more. File sharing can cause serious problems. First of all, it is illegal to download copyrighted materials, and you could end up in a lawsuit. Second, you are opening up your computer to all users of the file-sharing service! File-sharing services work by installing shared folders on your computer; any files stored in the shared folder are open for others to view, download, and save. Virus creators love file-sharing services; it is easy for them to hide a virus in a song (or any other file) and save it to millions of shared folders. When the song is opened, you get a special present...a virus. If you have a file-sharing program, remove it. Parents, check to see if your son/daughter has access to them. To remove them, go to the control panel and select Add or Remove Programs. Highlight the program and then click the Remove button.

Cyberbullying

Preventing cyberbullying

Educating parents, students, and teachers about cyberbullying is crucial. Students must understand the consequences of engaging in cyberbullying. For example, district leaders may decide that students would lose their Internet or instant-messaging accounts. Teaching them to respect others and to take a stand against bullying of all kinds makes a difference in creating an overarching school culture of anti-harassment and respect.

Stopping cyberbullying

Motives for cyberbullying differ, and so must responses and solutions. Unfortunately, no one-size-fits-all recommended response to or solution for cyberbullying exists. Cyberbullies are similar to traditional schoolyard bullies but often cloak their activities in anonymity.

Schools walk a fine line in handling cyberbullying that occurs off campus outside the school day. When schools reach beyond the district's boundaries to address cyberbullying after hours, parents can bring lawsuits claiming that the actions exceed the school's authority and violate students' right to free speech.

School personnel can be very effective brokers in working with the parents/caregivers to stop cyberbullying. They can teach students cyberethics and the related law. There are creative situations in which schools can work around the claim that their actions exceed the scope of their authority. An effective plan is to add a cyberbullying provision to the school's acceptable-use policy, reserving the right to discipline the student for off-campus activities if they are meant to have an effect on another student or they adversely affect the safety and well-being of a student while he or she is in school. This then becomes a contractual, not a constitutional, issue.

Parents'/caregivers' roles

Parents and caregivers must be the trusted adults to whom students can turn when things go wrong online and offline. Young people don't always turn to parents and caregivers, because they are concerned that the adults will overreact. Children tend to believe that telling someone about cyberbullying incidents will make matters worse. They worry that parents/caregivers will call others or the school, assign blame, and/or remove Internet privileges.

School personnel can educate parents/caregivers about steps to take in response to their children's being cyberbullied. A formal dissemination of symptoms, how to recognize cyberbullying, etc., is a productive step.

Getting Involved in Policy Development

Educators and community members participate in setting public-education policy at the federal, state, and local levels. According to the Virginia Commonwealth Educational Policy Institute's (CEPI) *Public Participation in Education Policy: Changing Roles,* "The role of public participation in educational policy has evolved over time within the framework of the federal/state/local control over education."

With the advent of Open Government laws, the Freedom of Information Act, and the increased access to information provided by technology, it is easier today than ever before to stay informed about the problems facing education, to interact with the educators and the policy makers at all levels, and to participate in the process through various mediums.

Educators and other stakeholders can get involved in educational policy either as individuals or as members of an advocacy group or association. According to the CEPI report, "Perhaps the greatest area of influence on educational policy comes from those who participate in the legislative process. Which programs receive federal funding or federal scrutiny in local and state practice is motivated in large part by public participation in the legislative process. The effort of focused educational lobbying has resulted in greater funding for specific programs as well as mandates for services without complete funding. This takes place in the form of both professional lobbying and also individuals testifying and participating in hearings on educational issues."

The following are ways for people in schools and districts to get involved in educational policy.

- public-opinion surveys and polling (surveys are a great way to discover support strategies for your initiative)
- direct mail and media announcements
- partnering with community organizations to support policy that benefits both school and community
- working closely with the local press
- developing fund-raising plans

- creating community committees for input and guidance
- forming a political-action committee
- inviting VIPs to your schools to show them what is going well and where help is needed
- having visitors talk with students, who often can tell them the story in a way that administrators may never think of
- recruiting students for decision-making positions (a number of states have enacted legislation providing for student members of the local school board so the student voice has greater representation in the formation of educational policy)
- getting to know the chief of staff for your mayor and other government officials
- visiting your state congressional or assembly representatives and educational-policy advisors
- using digital media to get the word out about school programs and plans
- participating in public meetings

The National Education Technology Plan 2010 encourages districts to be clear about the outcomes they seek; collaborate to redesign structures and processes for effectiveness, efficiency, and flexibility; monitor and measure their performance, and hold themselves accountable for progress and results. Districts need policies and procedures that will enable them to carry out their plans.

The Education Technology Action Network provides an avenue for educators and the public to get involved in the political process by amplifying and unifying messages in support of the systemic integration of technology to improve teaching and learning. ETAN's mission is to influence public policy makers at the federal, state, and local levels and to increase public investment in the competitiveness of America's classrooms and students.

ISTE's Priorities: "Top Ten in '10"

Educators and policy makers are committed to efforts that maximize positive transformations in teaching and learning. There is a common focus on increasing students' achievement and closing the achievement gap.

The International Society for Technology in Education (ISTE) identified 10 priorities essential for 2010. They are:

1. Establish technology in education as the backbone of school improvement. To improve our schools for the long term and ensure that all students are equipped with the knowledge and skills necessary to achieve in the 21st century, educational technology must permeate every corner of the learning process. From years of research, we know that technology can serve as a primary driver for systemic school improvement, including school leadership, an improved learning culture, and excellence in professional practice. We must ensure that technology is at the foundation of current educational-reform efforts and is explicit and clear in its role, mission, and expected impact.

2. Leverage educational technology as a gateway for college and career readiness. Last year, President Obama established a national goal of producing the highest percentage of college graduates in the world by the year 2020. To achieve this goal in the next 10 years, we must embrace new instructional approaches that increase college-going rates as well as high school graduation rates. By effectively engaging learning through technology, teachers can demonstrate the relevance of 21st-century education, keeping more children in the pipeline as they pursue a rigorous, interesting, and pertinent pre-K–12 public education.

3. Ensure that technology expertise is infused throughout our schools and classrooms. In addition to providing all teachers with digital tools and content, we must ensure that technology experts are integrated throughout all schools, particularly as we increase the focus on and priority of STEM (science, technology, engineering, mathematics) instruction and expand distance and online learning opportunities for students. Just as we prioritize reading and math experts, so must we place a premium on technology experts, who can help the entire school maximize its resources and opportunities. To support these experts as well as all educators who integrate

technology into the overall curriculum, we must substantially increase our support for the federal Enhancing Education Through Technology program. EETT provides critical support for ongoing professional development, implementation of data-driven decision making, personalized learning opportunities, and increased parental involvement.

4. Continuously upgrade educators' classroom technology skills as a prerequisite for "highly effective" teaching. As part of our nation's continuing push to ensure that every classroom is led by a qualified, highly effective teacher, we must commit to make certain that all pre-K–12 educators have the skills to use modern information tools and digital content to support student learning in content areas and for student assessment. Effective teachers in the 21st century should be, by definition, technologically savvy teachers.

5. Invest in pre-service educational technology. Teacher preparation is one of the most important aspects of a world-class 21st-century system of education and learning. A federal investment in a new, technology-savvy generation of teachers is critical. To ensure their success in the classroom, a pre-service teacher must be prepared to use technology and integrate it into the curriculum before their first day as a teacher of record. By fully funding programs such as Preparing Teachers for Digital Age Learners, we can ensure that the United States produces the most technologically savvy educator workforce in the world.

6. Leverage technology to scale improvement. Through federal initiatives such as i3 grants, school districts across the nation are being asked to scale up current school-improvement efforts to maximize their reach and impact. School districts that have led successful school-turnaround and -improvement efforts recognize that educational technology is one of the best ways to accelerate reform, providing the tools to ensure that all teachers and students immediately have access to the latest innovative instructional pathways. If we are serious about school improvement, we must be serious about educational technology.

7. Provide high-speed broadband for all. The connectivity divide may be the most critical aspect of both our digital divide and our learning divide over the next decade. We must continue our national commitment to ensuring broadband access for all students through initiatives such as the E-Rate program. Today's classroom applications require significant bandwidth that many schools lack. Students who don't have Internet access at home face a significant hurdle to participating in school assignments and producing good schoolwork—and their parents are hindered in school-to-home communication. We must provide high-speed bandwidth to our nation's classrooms and focus on the school-to-home connection so that all students can succeed.

8. Boost student learning through data and assessment efforts. In schools across the nation, teachers, principals, and district administrators are increasingly discovering the benefits of real-time instructional and curriculum-management systems. To maximize these efforts, we must provide educators with the systems, knowledge, and support they need to tailor their teaching strategies effectively and better meet the individual needs of each learner. Teachers' ability to use data to improve instruction is equally important to contemporary data and assessment systems.

9. Invest in ongoing research and development. Given the current push for both innovation and school improvement, it is essential that we as a nation invest in the research and development necessary to identify what is drives increased student achievement and why. Increased investment in educational R&D, particularly with regard to innovation in teaching and learning, ensures that we remain a global leader in education. By stimulating meaningful, broad-based research and the dissemination of such research, we can ensure that the quality of teaching and learning in our classrooms keeps up with the goals and expectations we set for our students.

10. Promote global digital citizenship. In recent years we have seen the walls that divide nations and economies come down, and of necessity we've become focused on an increasingly competitive and flat world. Educational technology is the great equalizer in this environment, breaking down artificial barriers to effective teaching and learning and providing new reasons and opportunities for collaboration. Our children are subject to greater scrutiny when it comes to learning and achievement compared with their fellow students overseas. We in turn must ensure that all students have access to the best learning technologies.

Summary

This chapter addressed the following essential components of implementing an e-learning environment:

- Key considerations for policy development
  - how federal and state policies drive those at the local level
- Examples of effective local, state, and federal policies
- Alignment of ISTE's "Top Ten Priorities" for developing educational-technology policy
- Numerous resources for developing acceptable-use policies, online safety for students, and education for parents/caregivers
- The fundamentals of K–12 technology security
- How to prevent cyberbullying
- Key considerations for:
  - a collaborative faculty plan for student consequences
  - media literacy
  - access to tools, security protocols
- How to get involved in policy development

Checklist

The following checklist is an inventory of actions and activities to use in setting policies and procedures for an e-learning environment:

☑**Federal and state policy drivers**
- Align local policies.
- Use ISTE's "Top Ten Priorities."

☑**Define policy outcomes.**
- acceptable use
- filtering
- security protocols
- online safety
  - students
    - Address cyberbullying.
  - all stakeholders
    - practices
    - procedures
    - how to ensure effectiveness
    - expectations for behavior
- Provide for flexibility and regular review.
  - Regularly evaluate effectiveness in moving toward goals.
    - Ongoing policy and practices communication
    - training for all school-community members
- Methods of involvement in policy development
- Address insurance for theft, damage, vandalism.
- Define a collaborative faculty plan for student consequences.

☑**How to develop media literacy**

☑**Accessing tools**

Chapter 4: Driving Effective Leadership

What is a good leader? In education, leaders are charged with inspiring and managing educators, students, school boards, and others in the community to achieve common goals. Strong leaders should be honest, competent, intelligent, and able to lead others to understand and share in the mission of excellent personal performance and high student achievement.

Leadership for technology-based teaching and learning in 21st-century schools calls for a holistic, dynamic approach with a shared-leadership model within the school. The transformation is complex, and no one person can have expertise in all aspects; thus districts should employ distributed intelligence. The leader taps the collective and individual strengths of stakeholders to design and launch an effective educational-technology program. In this model, all participant-leaders should be adaptable and flexible in order to reach short- and long-term goals.

In essence, leadership for today calls for the transformational model created by James MacGregor Burns in the 1980s, in which leaders engage stakeholders in the work of revolutionizing their world. The transformational foundation promotes shared values that become sources of the creativity and optimism required to draw new road maps to success. The alternative, transactional leadership, on the other hand, has been about managing within the routine. This model often incorporates "compromise" and negotiating to get buy-in from the community.

In collective leadership, there is a shared, collaborative vision that shifts from individual centered to collective centered; from teacher-driven static curriculum and instruction to learning based on student inquiry and the production of dynamic content. Teachers empower learners; leaders empower teachers.

The leader of an educational-technology program must create a successful foundation by developing a shared vision for educational technology within the school. He or she must lead the effort with honest communication, sharing the outcomes expected from the

program, modeling the integrating of technology, and building an effective, supportive infrastructure. The leader supports the cultural changes by helping others understand new processes, environmental shifts, and the accelerated pace and robust integration of technology that characterize true 21st-century schools. He or she provides professional development and understands that the impact of change for individuals is a significant piece of this leadership work.

In Michigan's Freedom to Learn program, administrators' professional development was a hybrid of educational-technology research, specifically that of one-to-one teaching and learning, and the Mid-continent Research for Education and Learning's (McREL) Balanced Leadership. Systemically adopting technology causes a dramatic shift in educational practice that presents both opportunity and challenge. The leader's ability to navigate and guide in a system undergoing transformation is critical for success.

Shared planning is important during transformation to reduce the fear that change attacks core values and beliefs. Leaders have to address others' fears and encourage risk-taking in a safe environment. McREL calls this "leading second-order change" in schools and outlines 11 leadership responsibilities necessary for facilitating it. Those responsibilities are the same for implementing instructional-technology programs.

Given IT's strong presence in schools, the superintendent's technology leadership is pivotal. However, this aspect of district leadership may present new challenges. School superintendents from districts of every size and demographic participated in the Consortium of School Networking's (CoSN) focus groups to address this topic. What follows is a summary of their findings.

1. Superintendents recognize that technology is critically and increasingly important in education. They embrace their leadership role as technology advocates who create the vision and set the tone for the use of technology in their districts. At the same time, many acknowledge that their own knowledge and competencies regarding technology aren't where they need to be.
2. Superintendents take pride in promising technology practices in their districts; but they also admit that effective, system-wide use of technology to support student achievement remains an elusive goal for a variety of reasons ranging from inadequate infrastructure and funding to uneven community support and gaps in educators' abilities.
3. Superintendents are keenly aware that disparate deployments of new technologies could divide schools into the haves and the have-nots; and they worry that their own districts and students could fall behind on their watch.

The complete tool kit for empowering the superintendent technology leader is available at http://tinyurlcom/3guvxvj.

CoSN also provides a white paper on *The Framework of Essential Skills for the K–12 CTO* (www.schoolcio.com/whitepapers/WhatitTakesEssentialSkills.pdf).

The following are 10 focus areas for successful leadership of educational-technology programs.

1. Vision

A shared educational-technology vision is aligned with a district's values and overall mission and is accompanied by an action plan that is practical and aligned with goals, timelines, and funding specifics.

For this process to be successful, the leader needs a solid understanding of the research on technology integration as it relates to student achievement, curriculum, and instruction. He or she can then articulate and clarify beliefs about technology integration and an anytime, anywhere approach and share study results that support this kind of implementation. The leader should also provide information and data that demonstrate the need to shift from traditional, industrial-age education approaches to those that help students engage in the 21st-century global marketplace.

The leader's ability to navigate and guide in a system undergoing transformation is critical for success.

Sharing and working with that knowledge helps the leader guide others' expectations and help them understand that technology in and of itself does not increase student achievement. It is the seamless integration of appropriate curriculum, instruction, and technology that drives students' progress.

2. Development/design

Planners should create procedures for pilots, evaluations, and adjustments prior to full-scale and final implementation. States and districts have had success with this process. Planning decisions include the specifics of the project; request for proposals (choice of vendor[s]); hardware; software; infrastructure; classroom management (physical and tactical); batteries; device storage; acceptable use and board policies; student use (home/school/travel to and from school); technology support; professional development for administrators, teachers, technology personnel, parents/caregivers, and community members; database management of resources; backup; disaster-recovery plan; and Internet access/safety/filtering.

The leader must collect data to evaluate the pilot and adjust the program where needed. Providing evidence of the program's success and limitation is helpful for stakeholders' understanding and buy-in.

Short- and long-term goals for program expansion and adjustments must be part of the development and design process. The program is essentially a work in progress, and a team reviews ongoing program feedback and interim assessments and then shares its findings, troubleshooting and making modifications.

The pilot should include a specific group of students, teachers, schools, and classrooms and observe students' and teachers' follow-up experiences. These students learn in a collaborative, project- and inquiry-based, dynamic learning environment and should be monitored if their future classrooms are traditional. The leader must have systems in place to ensure that students' levels of achievement continue even if they move from a digital learning environment back to a traditional classroom.

Case Study: Diocese of Columbus, Ohio

Education has changed for schools of the Diocese of Columbus. Classrooms in the area's Catholic schools are being transformed into more interactive learning environments. Students are taking advantage of technology to learn at their own pace and in their own way.

The Diocese established a one-to-one technology program for high school students at Bishop Hartley and Bishop Watterson High Schools. Its goal is to provide technology that facilitates interactivity in the classroom and enables students to learn in the way that suits them best.

Program highlights include:

- A wireless mobile solution that is available 24/7.
- A digital pen that enables input of content that a keyboard can't produce (diagrams, scientific notations, mathematical equations, and more).

The program's benefits are:

- Teachers use innovative, collaborative classroom tools and programs.
- Tablet PCs facilitate individualized instruction.
- Students concentrate on class content instead of delivery.

3. Curriculum and instruction

The leader must ensure that curricular design and pedagogy rely on technologies that will maximize teaching and learning and address common and measurable learning standards. Teachers change pedagogy when they know how to integrate technology into curriculum and instruction meaningfully. They learn through consistent, ongoing professional-growth opportunities that include practicing, sharing, reflecting, and debriefing within a structured learning community.

Understanding the difference between "low-level" and "meaningful" integration will guide expectations for the assimilation of curriculum, instruction, and technology. Keyboarding, word processing, and basic presentation development are examples of low-level integration. Project-based learning, independent research, problem solving, student collaboration, and data analysis, synthesis, and reporting are examples of the meaningful fusion of technology, curriculum, and instruction. Michigan's experience with professional development in its Freedom to Learn program shows that it takes, on average, three years for a teacher to become a highly skilled

expert in this practice. Ongoing, focused professional development, ideally using a coach/mentor framework, is necessary for institutionalized transformation to occur.

In a technology-rich environment, the dynamics of management are different from those in a traditional classroom. Planners should develop, communicate, and enforce a unified set of expected student technology-related behaviors. The leader must understand and support these new expectations and standards.

Effective and just-in-time technical support is important for uninterrupted instruction. The leader can help teachers become technology troubleshooters so that they are able to solve minor problems and also have backup plans.

4. Professional learning

Comprehensive, ongoing, focused professional development is important for educators and educational leaders. Teachers move from novice to expert over a period of three years, and the leader should provide support as well as training experiences that are appropriate for each teacher's skill set. Educators will move along the novice-to expert-continuum at different speeds.

Educational technology supports constructivist, student-centered classrooms, which means that teachers need techniques that will replace conventional, teacher-centered strategies. Thus the leader should develop plans that include time for teachers to learn new methods and new technologies. Models include a combination of the following: after-school and weekend face-to-face sessions, teacher-release time, retreats, summer-months workshops, and online, Web-based, and on-demand opportunities. The successful leader also carves out time for teachers to discuss curriculum, technological resources, and best practices and participate in coaching and mentoring experiences.

The leader also benefits from professional development, in learning the best uses of technology, methodology, and curriculum in a one-to-one environment. Their professional-learning plans should begin before any plans are implemented and continue through the pilot and beyond.

One effective strategy is to provide teachers with devices and training for a span of time prior to the students' launch. This scenario gives teachers individual and collaborative opportunities to explore and experience teaching and learning possibilities using technology and related resources. The leader can set expectations for this period of teachers' professional growth. The goal is to ready teachers to be able to engage in the whole classroom launch more effectively and efficiently.

The leader should encourage all stakeholder groups to benefit from professional development related to technology and curriculum integration. Groups can include administrators, teachers,

The leader and team must have plans for the following.

- ☑facilitating the early implementers' migration to the next grades; for them, teaching and learning have been transformed
- ☑multi-year use of devices: Will they move up a grade with current students or remain in the current grade for upcoming students?
- ☑professional-development plans for current and future one-to-one teachers, technology staff, and administrators
- ☑program expansion
- ☑costs and resources for expansion and scalability
- ☑refresh model for devices
- ☑students' migration to higher grades: from elementary to middle school, from middle to high school. Students with one-to-one experience have different learning skills and expectations from those utilized in traditional classrooms.

The leader can ensure a good instructional environment by doing the following:

- ☑Ensure that there are sufficient power supplies and surge-protected power strips.
- ☑Specify use of specific printers by specific students and teachers.
- ☑Enforce an acceptable-use policy that includes software.
- ☑Communicate disciplinary policies that apply to technology breaches.
- ☑Employ filtering software.
- ☑Make available a list of acceptable Web sites for student access.
- ☑Define and implement a plan for device reimaging.
- ☑Provide swap-out devices for loan.
- ☑Design and implement a technology troubleshooting plan.

technology personnel, parents/caregivers, and community members.

5. Professional Practice

The leader should model the use of technology to increase their own productivity in their professional work because it demonstrates commitment. They should visit digital classrooms regularly, establish lines of communication and systems for input and feedback, and communicate and discuss lessons learned in order to guide progress and program adjustments.

The leader also benefits from professional development, in learning the best uses of technology, methodology, and curriculum in a one-to-one environment. Their professional-learning plans should begin before any plans are implemented and continue through the pilot and beyond.

Change must be systemic, and all components should foster the transformation. The leader should monitor progress for alignment among policies, procedures, services, information, and engaging with technology. Ongoing reflection, rethinking, and redesigning among the professional-learning communities contribute to growth.

The leader should also understand the related social, legal, and ethical issues. It is important for the leader to model responsible decision making for policies and programs.

6. Operations

The leader should make sure that technology integration supports overall district systems for learning and administration and that the district systems are robust enough to support the use of technology. The more that school leaders and officials understand, support, and engage in the implementation, the greater the chance for the project's success and growth.

7. Assessment and evaluation

A system of ongoing and annual evaluation should be in place to determine how well the program achieves its goals and which measures need adjusting. Summative evaluations provide information about the program's overall success, parts that need improvement, and focused area s of response about the project's efficacy.

8. Communication

As they do regarding any change in schools, the leader must have ongoing and consistent communication and share the research and knowledge with other stakeholders and the community. This includes the good news as well as the challenges.

Ideas for communicating are: structuring scheduled meetings to permit different groups and stakeholders to have their concerns heard and addressed; facilitating immediate support where needed; learning from others who have traveled this same path; seeking help when needed; being highly visible and available within the project; supporting the risk-taking pioneers; providing printed or electronic newsletters and updates for constituents; providing Web pages and emails.

The leader can remind the community of the reasons for the program launch, the focus on students' preparation for the future, and the shared vision that provided the foundation for the effort. They can set expectations for next steps, keep the community posted on progress, provide samples of success, and use updates as part of a community communication plan.

9. The Implications of change

The leader should address the needs and concerns of educators. He or she can listen to and recognize differing perspectives, resolve problems (e.g., battery life, power strips), arrange for reluctant teachers to visit classrooms in which the project is successful, provide skeptics the opportunity to witness the zeal of teachers and students who have embraced the changes, and orchestrate scenarios for teacher-to-teacher problem solving, among other things.

Adaptability, flexibility, and change will be essential for the shared leadership team. As students become self-directed learners, teachers' practice will need to become

more of a resource, and they will spend more time as coaches and guides. The team should recognize when and how teacher change should happen and support it.

10. Sustainability

Funding short- and long-term educational-technology goals is part of the vision. Districts cannot count on one-time funding windfalls to subsidize short- and long-term technology goals. In times of tightened school budgets, technology is often the first area hit by cuts. With no silver bullets available, leaders must rely on focused and thoughtful funding planning with a collaborative team of district leaders. Even as it uses data to drive educational-technology goals, it is important for the district to look at its current technology resource allocations, return on investments, and total cost of ownership. Strategies for finding funds include resource recapture, cost avoidance, and fund reallocation. Leasing and parent/caregiver purchases through the school-vendor relationship can help as well. Chapter 10 will provide more financial information.

The Principal as Leader

The principal is the key leader, and his or her leadership skills will directly affect the program's success. Specific actions that demonstrate leadership and lead to desired results are below.

- Lead the identification of the school's shared vision and the purpose of the digital learning program.
- Communicate consistently with all community members—the good news as well as the challenges.
- Facilitate cooperation, unity, troubleshooting, and collaboration among staff.
- Create professional-learning communities for one-to-one teachers and parents/caregivers.
- Build a climate of culture shift and change.
- Ensure a safe environment for risk taking, trial and error, and mistakes.
- Develop, design, and implement consistent content and a schedule of professional development.
- Provide or facilitate just-in-time solutions to problems.
- Respond to individuals' engaging with change.
- Visit classrooms; interact with students and teachers.
- Model the use of technology in building operations.
- Ensure technology support and a process for problem solving.

Leaders are charged with inspiring and managing educators, students, school boards, and others in the community in order to achieve common goals. The combination of all district leaders' vision, expectations, and facilitation is required to ensure success.

For example, the principal's leadership is important in leading and supporting the changes required in 21st-century schools. The superintendent is clearly the top-level executive who can make or break an educational-technology initiative. He or she takes the district in the desired direction by circumventing obstacles, defining messaging, and garnering the provisions needed for a successful process. Also key to leading educational technology are the district's chief information and business officers and instructional technologists. Each person brings an expertise to the conversation and implementation that is essential for success. A district needs all leaders around the table, adding their unique skills and knowledge, to hone an effective initiative.

Summary

This chapter addressed the following components of leadership for an e-learning environment:

- definition and examples of transformational leadership for technology-enhanced schools
  - collective leadership—using the strengths of all involved
- research underpinnings
- stakeholder groups' and individuals' importance
- focal aspects of leading educational-technology implementations
  - change in culture
  - leaders' practices that ensure a good instructional environment
- the principal's importance in effective leadership
- components of sustainable leadership

Checklist

The following checklist is an inventory of important actions and activities in leading an e-learning environment:

☑**Leaders understand and articulate the role and actions of transformational leadership.**

- knowing the qualities of the collective-leadership model
- engaging the unique strengths of each stakeholder and group
  - superintendent
  - IT department
  - CFO
  - principals
  - department heads
  - teachers
  - students
  - board members
  - parents/guardians
  - community leaders
  - other partners

☑**Leaders facilitate culture change.**

- **time:** Promote time flexibility for change.
- **talk:** "Walk the talk."
- **plan:** Use written communication and establish accountability.
- **develop:** growth opportunities
- **learn:** Study the successes and failures of others.

☑**Leaders plan for each focal aspect of leading educational-technology transformations.**

- vision (see Chapter 1)
- plan for design and development (see Chapter 1)
- Create sustainable plans.
- Map curriculum and standards for technology integration.
- Leaders ensure a good learning environment.
- Define the expected pedagogical shift.
- Provide professional learning.
- Model professional practices expected in the ecosystem.
- Enlist an outside evaluator to assess the program's outcome.
- Use a systemic approach for policy and practices related to technology integration.
- Include operations as a key part of the system.
- Communicate effectively and on an ongoing basis with all stakeholders.
- Build and power up sustainability plans.
  - human resources
  - funding
  - maintenance
  - refresh
  - evaluation

☑**Ensure the efficacy of principals' leadership abilities relevant to the above points.**

Chapter 5: Creating Professional Development Systems

Professional Development

McKinsey & Company says, "The quality of an educational system cannot exceed the quality of its teachers." And professional development is essential to building teacher quality and the capacity of teachers to transform their classrooms. Formal systems for ongoing professional learning can lead to transforming educational environments, increasing student achievement, and, ultimately, creating high-performing schools.

The most effective of these programs are ongoing, collaborative, integrated with practice, and provided in an environment of continued support. The collaborative aspect of these programs is based in communities of practice, where members are empowered through a shared vision while still advancing their individual goals. Effective programs include a cycle of improvement in which teachers have an opportunity to learn something new, discuss with colleagues effective ways to implement the new learning in the classroom, try it in their classrooms and collect data, and then review the experience with colleagues and make adjustments for further implementation. An ongoing cycle like this leads to continuous improvement.

This is very different from traditional, isolated training experiences. Most professional organizations now differentiate between training and professional development. Teacher training refers to onetime or short-term training that is intended to develop specific technical skills. It is important, for example, for the teachers in a one-to-one laptop program to understand how to use the laptop. A teacher doesn't need ongoing training to understand how to use the functions of the computer, but the fact that the training is short-term doesn't diminish its importance.

Professional development, or professional learning, on the other hand, refers to a more systematized, continuous, coherent process of teacher development. The focus of these programs may vary depending on the perceived needs of teachers and administrators. Some programs may focus on teaching methods or integration of technology; others may focus on changing the classroom environment and activities; others may focus on student outcomes. These professional-learning experiences can take place face-to-face, facilitated online, or provided with an assortment of blended methods.

Professional Development for E-learning

Professional-development models must involve a digital component, especially when preparing for ongoing growth within an educational-technology program. This component can range from the use of computers or simple digital resources in traditional professional development to programs that are completely online and that allow teachers to participate synchronously and/or asynchronously. Synchronous online activity simply means that the online session takes place in real time. This method allows teachers to receive immediate feedback from the instructor and to participate in live collaboration with their colleagues.

With an Internet connection, a teacher can participate while on a beach in the Mediterranean, in pajamas at home, or even sitting at their desk at school. Asynchronous experiences mean that the online interaction does not happen in real time. The advantage of an asynchronous method is that it allows teachers the freedom to learn *anytime* and anywhere they want. The asynchronous method does not mean that teachers are unable to communicate with the instructor or collaborate with other colleagues. It only means that it may take some time to receive a response.

The models in the continuum fall into three main categories: face-to-face learning, online learning, and blended models of learning.

Face-to-face sessions

The traditional face-to-face session can play several roles in a systematized professional-learning program. In the most traditional sense, it can be used to deliver the type of "training" described above. Teachers gathering in the computer lab during contractual professional development to learn to use the district's new online grading system is an example of training.

Helping teachers build personal relationships that encourage professional collaboration is another valuable use of the limited face-to-face time that teachers have. There are human elements of communication that are lost when teachers work in a purely online environment. Verbal and visual cues, such as body language, can provide advantages in learning. Unfortunately, in most schools teachers are isolated, and until they have a chance to get to really get to know their colleagues and then engage in meaningful work together, local collaboration will flounder.

If you want teachers to experience what it feels like to be students in a one-to-one computing classroom, there is no better experience than having them actually become a one-to-one computing classroom of 30 students in real time and in real life.

Possibly the most important aspect of the face-to-face experience is its potential for modeling real-world experiences. In a face-to-face ongoing cycle of improvement, teachers should be learning how to integrate technology into their specific curriculum, discussing project-based learning approaches, and then modeling their lessons for each other.

Formal systems for ongoing professional learning can lead to transforming educational environments, increasing student achievement, and, ultimately, creating high-performing schools. The most effective of these programs are ongoing, collaborative, integrated with practice, and provided in an environment of continued support.

Online learning

There are noteworthy differences—advantages and disadvantages—in face-to-face versus online professional-development experiences. For example, online courses often provide interesting and effective opportunities for collaborating and allow the educator to have more control over time management and course pacing. Online platforms allow the learner to direct his or her own learning and provides independence of time and place.

These benefits seem to mirror some of the characteristics typically identified as belonging to adult learners, who tend to be independent and self-directed. Adults are generally looking for learning that directly applies to their situation and/or addresses a challenge for them in their work. As you can see, these characteristics seem ideally suited to the online learning environment. If an

adult learner isn't comfortable with technology or the digital platform, however, he or she may opt for learning experiences provided through the more traditional, face-to-face method.

Online professional learning, therefore, can present unique challenges for educators who are used to face-to-face learning. Interacting with the inanimate computer screen provides an inherent level of abstraction. Participants have to picture the instructor or collaborator, understand the intent of the content that he or she provides, and imagine *how* he or she is speaking in order to gain a better sense of the person's intent and personality.

To do this effectively, the participant must develop an online vocabulary that makes the digital content come to life. This can be a difficult shift for teachers, because they spend most of their day in face-to-face interactions where they are accustomed to using tone of voice, hand gestures, and facial expressions to engage their students. Overcoming these communication disadvantages is one of the major challenges of online learning. However, the generation of teachers that has been raised with social networking may be more attuned to communicating and learning in new ways online.

A major advantage of online learning environments is that they provide effective ways to examine issues from many perspectives. Teachers have the time to research best practices, reflect on their own practice, and then respond in a thoughtful fashion online. For many teachers this asynchronous learning provides a sense of security because they have time to reflect before they respond.

Because there is also a level of anonymity, participants may feel freer to say what they really mean. The blending of anonymity and, at the same time, connectedness is a powerful combination that provides a supportive foundation for challenging one's own beliefs and practices.

The goal of professional development is high levels of learning for everyone in the learning environment. Collaborative-learning communities, which are committed to continuous improvement and experimentation, help educators achieve this goal.

The way to maximize the success of online learning, however, is to develop communities of practice. The online community of practice is "an environment where teachers can generate ideas, build their knowledge base, and develop their expertise through collaboration," according to Melanie Zibit, a research professor at Boston College. "Online communities go beyond superficial exchanges to create a space where teachers share and benefit from each other's expertise, jointly committed to developing better practices."

This doesn't mean that collaborating with peers is the only way to maximize the online learning experience. A rich online experience is really a mix of collaboration and personalized learning. Within these collaborative environments, for example, a variety of digital resources can be shared that permit independent learning. These resources may include such things as tagged and archived research, tutorials, categorized Web-site bookmarks, and interactive learning models. Through these disparate resources, a teacher can participate in a discussion about their content, review the research on the subject, look at online examples, and deepen his or her understanding by working through a tutorial or an interactive learning module.

Regardless of the delivery method, good professional development for e-learning should go beyond software and hardware training. In all three delivery methods, teachers can receive guidance on how to create project-based lessons with technology, share best practices with other teachers, and delve into what it means to teach and learn with technology. Through ongoing opportunities to learn, experiment, and collaborate, teachers will learn to incorporate technology into the classroom and the curriculum so that it becomes pervasive and seamless.

Professional-learning communities (communities of practice)

The goal of professional development is high levels of learning for everyone in the learning environment. Collaborative-learning communities, which are committed

to continuous improvement and experimentation, help educators achieve this goal. Teams, online or face-to-face, - meet regularly for joint lesson planning and problem solving and to engage their members in improving their daily work to advance their students' achievement.

Over the past two decades, the concept of professional-learning communities, also known as communities of practice, has grown in popularity. Educators decide to collaborate to improve teaching and learning. These communities do not have to involve teachers within a common school or district. Because they can work online, educators can collaborate from anywhere and at any time. Members of the community are drawn together because of their similar interests. The community can then collaborate to study a chosen topic, review individual teaching practices, or even conduct action research.

When teachers can interact with other teachers who have similar teaching interests or goals, take the time to test and challenge their ideas, and review and process information with each other, they grow professionally. This learning experience grows exponentially with the expanding exchange of ideas and many sources of knowledge accessible from the various participants in the community.

Florida's Bureau of Educator Recruitment, Development and Retention has identified five essential dimensions, or attributes, of professional-learning communities.

1. *Supportive and shared leadership.* Through collegial participation, the administrator shares leadership with his or her staff by facilitating their work.
2. *Shared values and vision.* All professional-learning community (PLC) members develop a shared vision based on their commitment to the needs of their students and their desire to improve their teaching practice or develop their own skills and learning.
3. *Collective learning and application of learning (collective creativity).* PLC members move beyond existing procedures and teaching methods to design strategies for improvement based on high standards, the latest research, and best practices.
4. *Supportive conditions.* The environment is risk-free, so all members feel safe and comfortable enough to collaborate, communicate, learn, make decisions, solve problems, and share their results and products.
5. *Physical conditions and human capacities.*
   - time to meet and talk
   - the small size of the school or PLC
   - physical proximity of staff to one another
   - interdependent teaching roles
   - communication structures
   - school autonomy
   - teacher empowerment

Blended models

Blended models of professional development combine face-to-face learning with online learning. Often this involves a block of face-to-face interaction, varying from one to two weeks, followed by a longer period spent engaging with an online environment. Moore and Barab (2002) found that periodic face-to-face sessions were essential for sustaining the focus and engagement of teachers participating in an online learning community. Brosnan and Burgess (2003) found that providing an initial session face-to-face was important for developing effective social bonds. The development of this social network later encouraged more participation and open contributions from the participants. This is especially true when the collaborative community involves a variety of stakeholders.

Mentoring and Coaching

Mentoring and coaching enhance the professional-learning experiences of educators, but can play different roles in the learning process. The mentor's focus is the individual educator, their concerns, challenges, hopes, fears, and concerns. The mentor, sometimes called a teacher leader, develops a relationship of trust with the mentee so that he or she feels comfortable talking about sensitive personal and professional issues. Often the mentee actually chooses the mentor, which helps hasten the bond between the two. Although the mentor keeps in close contact with the mentee, no set agenda drives their relationship. The learning in this relationship happens much more organically and is usually driven by the mentee's perceived needs and challenges.

The role of a coach is substantially different from that of a mentor. Although this is also usually a one-on-one relationship, the coach has a specific agenda that drives their activity together. An administrator often sets the agenda and focuses it on the teacher's performance.

Coaching can happen in a variety of ways. For example, the coach can model what is desired of the teacher, or the teacher and coach can work together in the classroom, or the coach can simply observe the teacher and provide feedback. The most effective coaches work with the teacher to set specific goals and then provide enough support to make the teacher feel secure trying new things while encouraging the teacher to grow beyond his or her comfort zone.

Ongoing Support

If the goals for educational leaders are to transform educational environments, increase student achievement, and create high-performing schools, the leaders must provide ongoing support for professional learning. Leaders should develop plans that provide workshops and other training opportunities when needed and establish consistent and ongoing time for teachers to research best practices, to discuss curriculum and instructional strategies, and to reflect on their own practice.

It is important for leaders to provide a safe environment where teachers feel free to try new ideas without fear of failure. Frequent communication between the educational leaders and staff must be established not for the purposes of evaluation but rather to encourage teachers by providing consistent feedback and supporting their efforts to innovate.

Personal learning networks

Teachers must also take responsibility for their own learning. An important part of lifelong learning is building your own personal learning network. Daniel Tobin may be the person who coined the phrase. In his 1997 article "Use of Technology to Connect Communities of Learners," he defines a PLN as "a group of people who can guide your learning, point you to learning opportunities, answer your questions, and give you the benefit of their own knowledge and experience."

These are informal networks of professionals and expert sources that you can turn to when you need information. Information has continued to grow exponentially since the beginning of the technological revolution. Anyone who is engaged in professional life today understands that there isn't enough time or mental bandwidth to keep up with all the necessary fields that converge for a typical 21st-century worker. In this new, fast-paced environment of instant global communication and access to information, it is essential for educators to find credible and relevant information that they need to succeed and thrive in the world.

There are a number of ways that technology can aid in this process. For example, understanding how to search online databases efficiently, sharing bookmarks, and reading interesting blogs, wikis, and forums can help educators find needed information. RSS feeds from favorite pundits, news organizations, and Web sites shift the flow of information to have it reach educators automatically. Other communication tools, like Twitter, keep a dialog open between a person and their community. And other social-networking sites help create a community around a particular person, organization, or activity.

Original professional-learning networks revolve around one-on-one communication or face-to-face group interactions. The technological revolution created an explosion of information and also provides the means of connecting to a global network in ways that were unimaginable just two decades ago.

Models of Professional Development in Action

Now that we have examined a variety of professional-development strategies, let's take a look at how these strategies may be implemented effectively in real school settings. The One-to-One Institute, for example, uses most of the strategies described above when guiding a district through implementing a one-to-one program. It employs face-to-face professional-development sessions, online experiences, a coaching model, the development of professional-learning communities, and support for an ongoing cycle of improvement.

Well before an educational-technology program begins, teachers participate in a three-day Immersion Training. This training has four essential components. First, teachers participate in exercises that bond them together on the basis of the aspirations they have for the program and their concerns about the challenges they believe they will face. Second, teachers reveal their beliefs about how students learn best, and they begin to experience firsthand the potential shift in pedagogy that can happen when technology is implemented properly. Teachers also put their new learning into practice while they collaborate on instructional units and develop integrated lesson plans that they can immediately try in their classrooms. The final piece of the Immersion Training prepares teachers to participate in their online community of practice.

Although teachers comment positively about the hands-on nature of this type of professional development, the overwhelming majority of their comments are about the power of collaboration. This joy in collaboration is an important indicator that the desired bonding through face-to-face interaction is taking place. Below are a few quotations from teachers in Arizona.

"The most valuable part of this training was sharing, collaborating and getting new ideas."

"The most valuable thing for me was collaborating with my colleagues."

The LoTi strategy starts by assessing the use of 21st-century skills (i.e., critical thinking, collaboration, problem solving, and self-directed investigation) by teachers, then targets professional development for teachers that will increase their students' use of these skills. It follows a four-step model: assess, plan, implement, and sustain.

"The collaboration helped give me ideas about how to really make an impact in my classroom."

OnceWhen the face-to-face training is complete, the facilitator monitors the individual progress of the teachers and follows up in two ways. First the facilitator communicates regularly with the teachers, either through the online community or directly with each individual teacher through email. Over time the online platform established in the Immersion Training develops into more than a communication tool; it grows into a rich repository of ideas, lesson plans, and other resources for the teachers.

The intermittent face-to-face contact with the facilitator is also an effective way to support the professional growth of teachers, however. In this model the facilitator provides individual shoulder-to-shoulder coaching with the teachers in their classrooms. It is an approach that most teachers enjoy and value. In Atlanta, teachers said,

"I am excited about the online and face-to-face opportunities to continue working with teachers to further develop, share, and ask questions."

"The shoulder-to-shoulder coaching has been a fabulous follow-up to the initial training."

"I feel ready to move forward in new ways with my class."

The piece that completes the professional-development model revolves around administrative support for an ongoing cycle of improvement. A system of professional learning that will have the desired transformative effect includes a variety of online and face-to-face

opportunities. When school leaders embrace a systematized, ongoing, and long-term approach to professional learning, however, its potential to transform the learning environment is vastly increased. As one technology director said, "This approach has helped our school, with 40 middle school teachers, move from traditional classroom instruction into the 21st century."

The LoTi (Level of Teaching Innovation) Digital-Age Schools is another professional-development model that seems to be affecting academic achievement. The LoTi strategy starts by assessing the use of 21st-century skills (i.e., critical thinking, collaboration, problem solving, and self-directed investigation) by teachers, then targets professional development for teachers that will increase their students' use of these skills. It follows a four-step model: assess, plan, implement, and sustain.

Assess

The assessment step involves administering the LoTi Digital-Age Survey to identify trends in the professional-development needs of the targeted staff members (e.g., complex student projects, student-centered instruction) and also create an impetus for increasing teachers' technology implementation toward a target level.

Plan

The planning step addresses the creation of a Next Steps Action Plan that is tailored to the targeted staff members' aggregate survey data. The Next Steps Action Plan includes goals, objectives, actionable steps, and deliverables that will elevate the LoTi levels in the classroom.

Implement

In the implementation step, LoTi Trainers and Mentors deliver professional development that targets specific instructional needs identified by the aggregate survey data.

Sustain

LoTi identifies this as the most critical step. The sustaining step enables building administrators and National LoTi-Certified Trainers to sustain positive changes in classroom instructional practices through walkthroughs, peer mentoring sessions, and ongoing dialogue between the campus LoTi Liaison and the National LoTi Project School Coordinator. These events promote clear articulation among all stakeholders involved in the LoTi implementation process to ensure that all goals and objectives identified in the Next Steps Action Plan are being achieved.

You can visit the LoTi Web site (http://loticonnection.com/ldas_results.html) for more of its research and results.

Both models described above use the integration of technology as a catalyst for change. Not only do they help schools integrate technology into the curriculum, but they also expect students to use technology to explore, create, analyze, and, ultimately, innovate in the classroom. They both also strive to move teachers toward a more student-centered, problem-based environment. When they are successful in all the facets described above, schools have demonstrated real improvements in achievement.

Conclusion

There are a few fundamental conditions beyond technology that must exist if professional development is to build teachers' capacity. For example, teachers must be open to questioning their own practice and willing to grow and change. For this to happen across the entire school, the school's culture must be focused on continuous improvement.

Furthermore, the most successful professional learning happens when it is done in context. For example, a discussion about instructional strategies and pedagogy may be embedded in work related to developing and evaluating curricula and student assessment. This context provides teachers with a rich learning experience that (1) engages the content, (2) is ongoing, (3) extends into the classroom, and (4) provides an opportunity for teachers to be part of a professional-learning community.

Online professional learning also provides unique benefits. The benefits teachers most often cite are (1) increased understanding of content areas, (2) access to experts and information resources, (3) support for new ideas and teaching methods, and (4) increased confidence in their own abilities. Among the benefits, sharing information and knowledge was cited as the most useful aspect of the online experience.

In their investigation of the field, the Metiri Group found several essential elements for building and advancing effective teaching. In its report, *Professional*

Development: Ensuring Your Return on Investment, it outline a five-pronged approach.

6. Position the school as an innovative learning community that engages students, teachers, administrators, and community in 21st-century learning.
7. Use data and research to drive the design of professional-development programs as well as to ascertain the effect of such programs on the system goals. Then use that information to inform continuous improvement of the professional-learning offerings.
8. Provide time, resources, incentives, and requirements that engage all educators/teachers in formal and informal professional learning that meets excellent established standards and is aligned with system goals.
9. Provide options in the type, duration, pedagogy, location, medium, and formality of professional development, and differentiate among professional-development offerings to meet teacher participants' needs while also achieving system goals.
10. Establish and support teachers' engagement in both local and global professional-learning communities.

The professional-learning approaches and strategies presented in this chapter can build the capacity of teachers and improve the learning and teaching process, an enhancement that in turn is essential to students' improvement. Researchers agree that increasing student achievement depends on having effective educators. Linda Darling-Hammond (2000) reports that the only factor that is proven to have a direct effect on student achievement is "a recurring positive relationship between learning and teachers' flexibility, creativity, and adaptability." The key is effective professional development and teachers who model lifelong learning for the students, a goal of almost every public school.

Summary

This chapter addressed the following essential components in creating professional-development systems for an e-learning environment:

- new definition of professional learning for a new century
  - the difference between "training" and "professional development"
  - how to meet the needs of all educators in the learning spectrum
  - content areas for professional learning
  - best practices
  - tie-in with student achievement, curriculum, and standards
  - meaningful versus low-level technology-integration strategies
  - examples of effective processes
- personal learning networks
- online and face-to-face collaborations
- systematized approach
- leaders' expectations, teachers' practices, and accountability

Checklist

The following checklist is an inventory of important actions and activities for implementing professional development in an e-learning environment:

☑ **consistently scheduled within the life of educators**

- differentiated, customized for each learner on the continuum
- ongoing, regular
- part and parcel of leading and teaching experiences

☑ **content**

- meaningful integration: mapping curriculum and standards to technology use
- demonstrated tie to student achievement
- development of lesson plans
- customized, relevant, and focused content
- Consider the organization's needs.
- Focus on best practices and research.
- Address desired shift in pedagogy.
- computer-based assessments: formative and summative
- Use data to drive teaching and learning decisions.

☑ **professional-learning content delivery**

- blended: face-to-face and online
- coaching/mentoring framework
- just-in-time strategies to respond to needs
- online collaboration
- communities of practice
- immersion processes
- regularly scheduled professional-learning communities

Chapter 6: Using Digital Content in Curriculum

Technology has tremendous potential to transform teaching and learning, although merely adding technology doesn't change classrooms into better learning environments. Meaningful change will happen only through thoughtful, systematized planning for integrating tools and using digital content.

The textbook—the staple of the 20th-century classroom—is losing ground to digital alternatives (see "Will Print Textbooks Disappear?" later in this document). Higher education has led the charge away from print, driven by students' concerns about the rising cost of books required for college classes. According to a September 2, 2009, article in the *Washington Times* ("Digital Texts Could Turn the Page on Print Costs"), "Booksellers say they see a palpable backlash against the cost of paper books, which quickly go out of date and cost the average college student about $1,000 a year."

In response, college textbook publishers have begun offering a variety of digital options. McGraw-Hill, Pearson, Houghton Mifflin Harcourt, and a number of other publishers now sell entire books or individual chapters in digital format, and several companies have worked together to launch CourseSmart LLC, which offers thousands of textbooks online in an e-book format. Other, smaller supplementary content repositories and programs exist as well.

The K–12 market is demanding e-textbooks too. Their appeal for schools that have one-to-one or other technology-rich implementations include lighter backpacks for students and the ease with which the texts can be distributed, stored, and updated. Additionally, dynamic texts are consistently current with up-to-the-minute information.

Digital content has the power to transform teaching and learning. Before digital resources, the knowledge base was static and teacher directed. Digital migration allows teachers and students to be creative gatherers and producers of content.

E-texts address some of the problems of printed textbooks. But there have been articles in the press about the failures as well as the successes of e-textbook programs. Some feel that the price of the digital version of a book is still not low enough, especially considering that it can't be resold; and there is dissatisfaction with the platforms on which the e-textbooks are viewed.

Such concerns are even greater in a K–12 learning environment, where educators strive to support many learning styles, engage students through a variety of media, and teach them to be sophisticated consumers, interpreters, and users of content.

Digital curricula can be transformative. Using these resources lays the foundation for an instructional shift. Students and teachers can create and use just-in-time content that matches instructional goals, is relevant and meaningful, and is not static and outdated. Information becomes vibrant, questioned, researched, and pertinent to learning. Students manipulate and explore until the content provides meaning or provides answers to overarching questions. Students can access content in a mode that meets their needs best; this opens the door for all students to be successful, not just the ones who are thriving with textbooks.

Digital content has the power to transform teaching and learning. Before digital resources, the knowledge base was static and teacher directed. Digital migration allows teachers and students to be creative gatherers and producers of content. They have at their fingertips the keys to global data, research, and analysis formerly available only through days or weeks of laborious digging. While there remains tremendous value in the archeology of research, development of higher-order skills, such as analyzing and synthesizing of information, is required for today's learners to be successful.

In addition, districts can develop their own learning-management systems with community-developed curricula, assessments, and resources. This allows for personalization, common assessment development and ongoing feedback/data regarding students' progress.

We define digital content as electronic images, text, video, and sounds. Use of digital media expands educators' ability to meet diverse learners' needs beyond what they can achieve with traditional resources. A combination of digital content and the right software and online tools offers students options for obtaining information and demonstrating understanding. These opportunities help engage each student by providing the right level of challenge for him or her. This means more than mere transliteration of textbooks to e-texts or flat PDFs. Interactive content in a wide variety of forms can allow many more children to be successful.

Common features of digital content include:

- multimedia elements, such as still images and graphics, video, virtual reality, animations, simulations, audio, music, and interactive and gaming elements
- embedded tools (survey, calculator, spreadsheet, pen-based technology, etc.) to facilitate students' highlighting, annotating, calculations, and more
- additional tools (wikis, video/graphics editors, academic networking tools) to support collaboration and creation
- a variety of languages
- adaptive and assistive technology designed to meet special needs
- embedded links to external sources and access to remote experts and mentors
- technologies that evaluate students' responses, provide customized content, and redirect students

to data-indicated areas of need
- a seamless continuum of instruction and assessment
- the ability to be updated and enriched continuously and seamlessly
- site licenses or subscriptions that ensure a dependable supply of "perfect" copies
- the ability of teachers to search, sort, and select by standards-based needs and queries
- Options for exporting, reformatting, and combining text and other content so it can be used beyond the original package for presentation and dissemination in various ways

In addition, schools today need to save money, which migrating to digital content and away from textbooks can address. For example, the Vail (Arizona) School District went from $51 to $9 per student textbook expenditure between 2006 and 2009 when it instituted its Beyond Textbooks (digital content) program (http://beyondtextbooks.org/what-is-bt/).

Will Print Textbooks Disappear?

With a number of states now offering schools the option of purchasing digital content and equipment with funds previously earmarked for textbooks, some are predicting the demise of the print textbook as we know it today. How likely is this? And how desirable?

Critics of textbooks point to the following drawbacks:

Cost: K–12 textbooks cost the state of California more than $400 million a year, according to the California Open Source Textbook Project, while the Texas Education Agency reports that Texas schools spent $621 million in 2006–2007 and, on average, about $500 million a year on textbooks. And costs are rising. Between 1986 and 2004, college-textbook prices nearly tripled. While less precise numbers are available for K–12, the trend is alarmingly similar.

Size and Weight: According to a 2001 study by the Simmons School of Health Sciences, "Many school children are carrying backpacks far too heavy for their developing bodies" – exceeding the 15 percent of body weight recommended by American Academy of Orthopedic Surgeons. Tremendous amounts of time and energy are consumed in loading and unloading palettes of new textbooks as they are delivered to districts and schools, distributing books to individual classrooms, and having students sign books in and out in order to track their location. Valuable warehouse space, complete with energy-consuming climate-control equipment, is typically required to store thousands of textbooks during the summer months and serve as an ongoing repository for unused and unwanted books.

Lack of Flexibility: As new students enroll or textbooks are lost, it is difficult to respond quickly. For example, according to the California Performance Review, in 2005 more half a million students did not have textbooks to use in class and approximately two million could not take textbooks home to do homework. Because California, Texas, and Florida represent close to 30 percent of

Case Study: Alexandria City Public Schools

Alexandria (Virginia) City Public Schools has equipped every student and teacher with an HP Notebook PC, enabling the use of a learning-management system and a variety of computer-based instructional resources.

Program benefits include:
- improved technology literacy
- ability to test, re-teach, and re-test on state standardized tests
- near-paperless workflow
- access to external instructional resources, including a virtual teaching consortium
- guaranteed quick turnaround or immediate swap for notebook PC hardware service needs
- three-year lease program through HP Financial Services meets school district's cash-flow needs while helping ensure regular technology refresh

The reality of one-to-one technology access is living up to the promise. Technology is treated as an integral part of Alexandria curriculum. A Technology Services director coordinates implementation of the system's technology plan, using input from and involvement of students, teachers, staff, administrators, parents, and citizens.

the textbook-adoption market, it is hard for districts in other states to find texts customized to their standards and needs. And the fact that the typical adoption cycle is at least six years means that students are perpetually learning with textbooks that are out-of-date, and in some cases obsolete.

Even those who believe that textbooks will continue to play a role in education for many years to come expect that digital content, from digitized versions of the textbooks themselves to multimedia content that can be viewed as merely supplementary, will become increasingly prevalent and important. Whether such content replaces the print textbook or simply lives side by side with it remains to be seen.

When educators and students do digital research and use digital content and resources, they become critical explorers, agile problem solvers, and communicators who use imagination and initiative to guide the teaching and learning processes. Students become masters of their learning while connecting to the world beyond four classroom walls.

Teacher buy-in, which curriculum and instruction need to develop in order to educate students for a rapidly changing world, is essential to such a transformation. Some guidelines for incorporating technology into the curriculum include:

- Technology should support student activities that would otherwise be difficult or impossible.
- Technology should be equitable and address all learning styles.
- Curriculum should be developed with the vast new set of digital content in mind.

Digital content packages:

- address individual learning styles
- are flexible
- quickly adjust to fit ability levels
- can be translated into different languages
- can be reformatted for presentation and dissemination in various ways
- include graphics, video, virtual reality, animations, simulations, audio, music, and interactive and gaming elements
- engage students through a rich and varied array of intelligences

With effective professional development, teachers should feel well prepared and equipped to inspire such learning activities as:

- planned and spontaneous research
- evaluating the reliability of various online sources
- taking notes quickly and efficiently
- peer mentoring using multimedia presentations
- publishing for a genuine audience
- writing and editing using a variety of tools
- collaborating locally and globally

Using digital resources helps transform traditional practice. Where students would traditionally perform static research and write paper-and-pencil reports, digital resources allow them to explore topics online in a dynamic fashion and use multimedia tools to create learning products, such as podcasts, videos, and vodcasts. Where students would wait long periods for feedback, formative assessments via an LMS or other online tools permit just-in-time demonstrations of learning and immediate feedback to inform next steps. Where students' collaboration previously would consume large amounts of instructional time in using static tools, online tools enable simultaneous interaction and the development of collaborative products. Media literacy is a crucial skill that must be developed, monitored, and maintained.

With the influx of digital content comes the responsibility of ensuring students' and school safety. The 21st-century cyberskill set includes safety, wellness, literacy, appropriate online behavior (and appropriate conse-

To transform today's classrooms into appropriate 21st-century learning environments, we have to provide students with rich digital content that goes far beyond digitized print delivered over scaled-down devices. In making the move to digital content, it is important for schools to consider two factors: the ideal learning platform and the form in which the content is delivered.

quences for inappropriate behavior), and generally balancing risk taking and exploration with safety and boundaries. The school and district will have a comprehensive set of policies and expectations established and communicated among students, parents/caregivers, faculty, staff, and all stakeholders. Chapter 3 discusses such policies.

Effective decision making in the area of digital content includes careful examination of state and local standards to determine the best way to integrate digital resources. Educators can set up a community of practice to share, debrief, and assess digital tools and resources. Teachers can research and create digital curricula, align them with standards and instructional goals, and then index it all for archiving, retrieval, and further production. They can map students' performance objectives to an instructional calendar that includes assessments and analyses of new instructional processes.

To transform today's classrooms into appropriate 21st-century learning environments, we have to provide students with rich digital content that goes far beyond digitized print delivered over scaled-down devices. In making the move to digital content, it is important for schools to consider two factors: the ideal learning platform and the form in which the content is delivered.

Budget-conscious schools may be tempted to purchase "inexpensive" e-text readers or netbooks with fewer features than full-fledged computers, but such a move can actually cost a district more if the new devices do not meet all the needs of the students or teachers who will be using them. In selecting a mobile device for classroom use, it is important to view it as a total learning platform and look for a device that supports all instructional and district goals, not just one or some of them. That is, both form factor and computing capacity should be taken into consideration.

Rich digital content can take many forms. It can be provided in standards-based packages that build on textbooks and have teacher's guides, assessments, and multimedia content all included and aligned with standards. It can be created collaboratively, in open-source format, by a variety of experts. Or it can be drawn from many sources: subscriptions, free online resources, and other digitized material customized locally to meet the needs of a particular classroom, grade, or district. All this can then be shared through a learning-management system.

Rich digital content, delivered on flexible mobile computers, can revolutionize the ways in which elementary-, secondary-, and post-secondary-age students learn and grow. Learning is no longer contained in the physical classroom. Learning can occur anytime, anywhere, and the Internet and all its possibilities make learning global.

The most effective digital learning environments bring together the three C's—consumption, collaboration, and creation—by:

- engaging students through a rich and varied array of innovative media and learning experiences
- being flexible and adaptable, allowing students to learn at their own pace and in their own style
- offering teachers and administrators the power to select and modify content as desired
- connecting students with outside resources as well as experts and mentors who support their learning
- providing a seamless continuum of instruction and assessment
- providing data to teachers to inform practice and enhance students' performance
- offering opportunities for students to collaborate and share ideas through social media
- challenging and motivating students to create their own meaning in the form of blogs, multimedia presentations, and other original content that builds on what they learned and is delivered to an authentic audience

Digital-Content-Related Facts

As of early 2010, there were 1.7 billion Internet users(www.internetworldstats.com/stats.htm) and 206 million Web sites (www.netcraft.com). There were also:

- 126 million blogs on the Internet (www.blogpulse.com)
- 3 billion photos uploaded to Facebook (www.facebook.com/press/info.php?statistics)
- 1 billion videos served daily by YouTube (www.youtube.com)
- 273 million unique visitors to Facebook, MySpace, and YouTube (http://blog.compete.com/2010/01/25/list-of-top-50-websites-in-december-2009/)

The table below provides a comparison of digital and analog (traditional static) content.

Digital content	Analog content
multilayered	single-layered
dynamic	static
quick	slow
accessible	insular
mashable*	stand-alone
mobile	rigid

(Evan Abbey, http://eabbey.blogspot.com)

* *Mashable* means that digital content can contain text, graphics, audio, video, and animation blended from pre-existing sources to create a new resource.

Digital content can be Web delivered, downloadable, teacher –created, and/or premium (paid content). The following are important considerations when "buying" or selecting digital content:

- relationship to instructional goals
- ability to select which parts to buy
- purchasing for only the desired population of students
- paying for only the time the content will be used

Types of digital content

Category	Some examples
comprehensive instructional software	Destination Success (Houghton Mifflin Harcourt), SuccessMaker (Pearson), Breakthrough to Literacy (McGraw-Hill)
sheltered search and content libraries	Questia, NetTrekker, ABC-CLIO, ProQuest K–12, SAS Curriculum Pathways
video and multimedia collections	Safari Montage, Discovery streaming, BrainPop, SAS Curriculum Pathways
games, experiments, and simulations	MuzzyLane, Vernier, Explorelearning
online classes	Apex, Florida Virtual School, Odysseyware Online, Education 20/20, Atomic Learning
tools for publishing, analyzing, collaborating, visualizing, modeling	Google Apps, Microsoft Office, Inspiration, Open Office, Adobe Creative Suite, GIS for Education (ESR), wikis, social-networking tools, Microsoft Office 365 for Education
curriculum management and assessment tools	Dyknow, HP Classroom Manager, Project Tapestry, EdMin, Qwizdom, Blackboard, eInstruction, Moodle Eduware

School of One, New York City

Differentiated learning is a goal for many schools today, but few take it as seriously as the designers of NYC's School of One, a pilot program that is part of the NYC21C school-reform initiative, aimed at innovating instructional practices to prepare students for careers in the 21st century. Piloted at one school in summer 2009; School of One expanded to three sites in early 2010 and is scheduled to reach 20 schools in three years.

In the School of One model, students take a diagnostic exam to determine the learning goals they have

to work on; this is called the playlist. Students also complete a learning profile that indicates their interests and their learning styles. Each day, optimization software looks at which playlist items are needed according to the prior day's assessment (for example, five students have to work on multiplying fractions, while 10 are up to adding fractions) and creates new classes to meet those needs.

When lessons are provided to the students, they are matched to the students' learning profiles to further enhance personalization. (For example, of the five students who work on multiplying fractions, two may prefer live instruction, while three may prefer fraction games.) Over time the system will use assessment data to determine which lessons are most effective, with the ultimate goal of creating a vastly more efficient and engaging learning experience for students as well as teachers.

Is there a role for textbooks in this learning model? According to Jonathan Skolnick, manager of program operations, "School of One is based on the theory that while computer-based instruction plays an important role in individualizing instruction, it should not be the only way, or even the most important way, that students learn. Students who learn best from live instruction with teachers, or with workbook or textbook materials, are assigned them as needed."

While not ready to do away with textbooks as content sources, Skolnick believes that a modular approach that takes advantage of digital content is needed. "Digital textbooks help us deal with the logistical challenges of printing out different worksheets from different textbooks for different students, because students can access the digital material through a customized portal. Our program tags each workbook or textbook lesson with certain attributes so we can match it to particular students' needs. Over time we can create a marketplace of different textbook vendors and select the best lessons from each. A student might receive a fractions lesson from one vendor's textbook and a geometry lesson from another vendor's textbook. This may enable us, down the road, to pay vendors on a per-use basis, with the most successful lessons being deployed most frequently."

Sample district implementation: Vail School District

Once an old-fashioned ranching community with a one-room schoolhouse, Vail, Arizona, now has 13 schools, more than 9,000 students, and a decidedly 21st-century approach to education. The Beyond Textbooks initiative grew out of ideas germinated at Empire High School, the district's first one-to-one school. Empire, which opened in 2005, is a wireless laptop school that, from the start, was designed to allow students to learn digitally. With a few rare exceptions, classes use no print textbooks, focusing instead on digital content. With the launch of Beyond Textbooks in 2008, all schools in the district have access to digital content.

Described in more detail in the articles listed below, the Beyond Textbook initiative is powered by the Vail Interactive Curriculum Calendar Initiative, a dynamic Web site that allows teachers to house and share resources over the entire district. It is built around state standards, and formative assessments are linked to each

one. From there it has grown as teachers add to it—their favorite content from free or subscription-based sources as well as lessons they've created themselves. The idea, says the district's CIO, Matt Federoff, is to "harness their enthusiasm, see what they're passionate about, and give them a place to shine." He points to a fifth-grade teacher who has posted nearly 20 lessons and a middle-school speech therapist who has added a great deal of information about ways of helping students who struggle with reading meet the K–5 language standards.

Beyond Textbooks, as its name makes clear, is an attempt to build a curriculum that does not rely on the traditional print textbook. "No one vendor can provide it all," Federoff says. "Think iTunes: We don't buy albums; we buy songs. I want the Civil War from one vendor, but I want World War II from another...the best bits and pieces from many sources that most closely match our instructional goals. Invert the curriculum!" The bits and pieces that are part of the digital curriculum are often free content that teachers create or find online.

A one-to-one setting is not necessary to use the Beyond Textbooks calendar, which includes offline lessons as well as audio or video content that teachers can share with large groups by using the projectors, ceiling-mounted screens, and enhanced audio speakers found in classrooms throughout the district. However, it is Federoff's hope that one-to-one access will be more widespread in Vail in the years to come. That will happen, he says, only if "we can afford it and the right device comes out." The right device, he says, would "have the size and pricing of the netbooks but with the fit, finish, and trim we're accustomed to with our laptops, at a price of $500 or less. What I would see as ideal is netbooks in various configurations. In K–5 they'd be on carts that can be moved around, in six through eight there would be classroom sets in every room, and in nine through 12 we would have one-to-one."

Vail School District's original plan was to phase the program in a few subject areas at a time, but everybody wanted in from the start. "I never imagined just how fast it would take off and how far it would go," Federoff says. "In all the years I've been in this line of work, I've never seen something with this much uptake."

He feels confident that other districts will have similar success if they try moving beyond textbooks. "Once folks see what that can look like, and how content is delivered in a post-textbook world, all sorts of other things become possible."

Resources:

The Vail School District has five elementary schools, three middle schools and three high schools, as well as two charter schools. As of the start of the 2009–2010 school year, it served nearly 10,000 students, and the numbers were expected to grow.

The program at a glance

Empire High School, a laptop one-to-one school, opened in 2005 with an emphasis on digital content. The Beyond Textbooks initiative, launched in 2008, extended Empire High's textbook-free approach to the entire district.

To learn more about Beyond Textbooks:

Intel's Visionary Conference, 2008
Vail School District CIO Matt Federoff first presented plans for the Beyond Textbooks project at Intel's 2008 conference.

"Transforming Curriculum in the Technology-Rich Classroom"
K–12 Computing Blueprint's Webinar, which took place in April 2009, is now available on demand. Matt Federoff was a featured speaker, profiling the Beyond Textbooks program.

"In a Digital Future, Textbooks Are History"
Read about Vail in the New York Times.

"Free at Last"
The cover story of the June 2009 issue of *T.H.E. Journal* takes an in-depth look at the Beyond Textbooks program.

The Future of Textbooks: Evolutionary, Revolutionary or More of the Same?
This monograph, which is part of the 2009 CoSN Compendium, features Vail and several other districts that have made unusual strides away from the textbook-based curriculum.

"Textbook Deathwatch"
Tech & Learning, August 2009
(www.techlearning.com/article/22122)

Sample state initiative: California's Free Digital Textbook Initiative

In May 2009, California governor Arnold Schwarzenegger highlighted his digital-textbooks initiative at a local high school. This "first –in the nation" initiative was introduced as a method of providing schools and students a way to access textbooks that are less expensive, easier, and lighter. The first phase, which took place in the summer of 2009, involved the review of free digital high school math and science content by a state panel that made recommendations to schools.
Additional content will be solicited and evaluated in the years to come; there are plans to create a statewide Web site highlighting available digital textbooks. According to the governor's office, this initiative has the potential to save California's schools millions of dollars. For more information, visit http://gov.ca.gov/index.php?/fact-sheet/12455/ or www.clrn.org/fdti/FDTI_Report.pdf.

Summary

This chapter addressed the following essential components of using digital content in an e-learning environment:

- new-century definition for school resources
- functionalities of digital content for curriculum
- strategies for differentiating and personalizing teaching and learning
- examples of digital content and uses
- common features of digital resources
- the three C's defined
  - consumption
  - collaboration
  - creation
  - multimedia elements, such as still images and graphics, video, virtual reality, animations, simulations, audio, music, and interactive and gaming elements
  - embedded tools (survey, calculator, spreadsheet, etc.) to facilitate students' highlighting, annotating, calculations, and more
  - additional tools (wikis, video/graphics editors, academic networking tools) to support collaboration and creation
  - a variety of languages
  - adaptive and assistive technology designed to meet special needs
  - embedded links to external sources and access to remote experts and mentors
  - technologies that evaluate students' responses, provide customized content, and redirect students to data-indicated areas of need
  - a seamless continuum of instruction and assessment
  - the ability to be updated and enriched continuously and seamlessly
  - site licenses or subscriptions that ensure a dependable supply of "perfect" copies
  - the ability of teachers to search, sort, and select by standards-based needs and queries
  - options for exporting, reformatting, and combining text and other content so it can be used beyond the original package for presentation and dissemination in various ways
- the ability to create and produce content within dynamic, digital materials
- revenue-positive effects researched and communicated
- a researched listing of digital content resources and their pros and cons related to curriculum, standards, and student outcomes

Checklist

The following checklist is an inventory of important actions and activities for using digital content in an e-learning environment:

☑**Systemically redefine acquiring and using school content and instructional and supplemental resources**

- Identify digital content that responds to students' abilities, needs, pace.
- Consumption, collaboration, and creation are focal points.
- Transform pedagogy best practices for universal-skill development, constructivism, and personalization.

☑**Facilitate a systems shift: evolution from static to dynamic resources**

- Differentiate and personalize the learning process.

☑**alternatives to e-textbooks, flat PDFs, i.e., authentic, just-in-time digital resources**

- Use images, video, text, and sound.
- interactive content in a wide variety of forms
- Common features include:

Chapter 7: Managing Classrooms for Change

Because classrooms are complex systems that are affected by many factors, there is no cookbook approach to classroom management or one approach to managing change that works in all situations. If teachers are going to be successful, they need training and hands-on experience in facing the fast-paced problem solving that is required in the classroom.

It is also important to broaden the definition of classroom management for student-centered classrooms in order to maximize the benefits of access to technology. Getting to know, understand, and build relationships with students is the first step. In effective classrooms, teachers move away from controlling students to focus on their own ability to create and implement learning environments that engage students.

Students are more likely to be engaged if the learning is personalized to include what a particular student learns, how a student learns, and when and where a student learns. Technology is a great facilitator. Creating innovative opportunities for students to learn can engage them in new ways. A teacher's skills in organization, problem solving, and communication and his or her understanding of students make a difference. The quality of the content and the depth of the interaction students have with it matter most for engagement.

Classroom teachers are the key

A 2005 OECD report says, "Raising teacher quality is perhaps the policy direction most likely to lead to substantial gains in school performance." While the technology revolution is creating a paradigm shift in education, change is never easy. Most teachers are used to the teacher's role

Students are more likely to be engaged if the learning is personalized to include what a particular student learns, how a student learns, and when and where a student learns. Technology is a great facilitator. Creating innovative opportunities for students to learn can engage them in new ways.

as a content expert who imparts wisdom and to students being passive recipients of information. Because this model may be the only one a teacher has experienced, and the teacher has most likely been successful within this model, it may be difficult for him or her to understand the need to shift to a new model. It is difficult to move toward a new reality without really understanding what it will look like.

Although the role of teachers in a modern classroom may be different from that in a traditional classroom, teachers remain vital to students' success and play a variety of roles. At times they focus on the individual learning needs of each student, and at other times they are content experts with just-in-time direct instruction. The biggest difference is that students begin to drive their own learning using digital tools and become collaborators in the process of learning. Teachers must learn to empower students to make decisions and to learn to guide them as they develop appropriate learning strategies.

There are a number of digital tools that help facilitate this new role of students. The classroom learning-management system, along with blogs, wikis, and social-networking tools, provides dynamic platforms for communication and collaboration in and outside the school. Uninterrupted access to the Internet allows students to find primary sources of information and other dynamic content that can replace the antiquated and static content of textbooks. Online formative and summative assessments give teachers the tools to make data-driven decisions about instruction, as well as provide students with real-time data with which to begin assessing their own understanding of content and their own learning needs.

Good teachers have always played a key role in students' success. It is obvious that teachers continue to play a key role in the ubiquitous-technology classroom, but the current thinking about what constitutes a good teacher may be insufficient. Although there are many definitions of teacher quality, there is a growing consensus regarding the characteristics a good teacher possesses. The No Child Left Behind Act identifies the three qualities most commonly associated with teacher quality as education, certification, and subject-matter knowledge. Several years of teaching experience also plays a major role in teacher quality and student achievement.

Several years of teaching experience, a teaching degree, and appropriate content knowledge, however, do not guarantee that teachers will be able to facilitate the student-centered, personalized digital learning environment. In this new, ubiquitous-technology classroom, teachers must also be flexible, willing to change, and able to create learning environments that allow each student to achieve their individual learning goals.

Alignment of curriculum to standards

Successful students and schools are most often measured by how well students do on state standardized tests. It makes sense, then, that schools have a way to ensure that students are learning the content that will be tested on the state exam. Aligning a school's curriculum to the state's standards and benchmarks is an important first step in increasing student achievement.

State standards and benchmarks are not a curriculum. State standards provide an age-specific framework of big ideas and concepts believed to be important in a subject area. The associated benchmarks identify the specific concepts and skills necessary to demonstrate mastery of the content. A school's curriculum, however, brings to life the concepts and skills that are identified in the state standards and benchmarks.

A common process used to align a school's curriculum with the state's standards and benchmarks is to start by extracting the key concepts and skills embedded in the document. Once the concepts and skills are extracted, they can be sequenced in a way that takes into account variables within the school and classroom. These variables may include things such as students' prior knowledge and readiness, the school calendar, the class schedule, and alignment with instruction in other content areas.

Aligning the curriculum to your state standards and benchmarks is an important first step to increasing student achievement, but it is only the first step. For the curriculum to have the greatest impact, it should meet the needs of the individual learner and be tied to ongoing formative and summative assessments.

Many schools look for shortcuts to this process and purchase content that has been organized on the basis of typical class offerings and has aligned this class content to a particular state's standards and benchmarks. Textbook companies have been doing this for years. As districts continue to move to digital solutions, a diverse group of other content providers has emerged. This content is not inherently good or bad. Purchasing aligned content can provide great resources. Aligned content, however, is not a curriculum, and should not be implemented as such.

Using a textbook as the curriculum is no longer acceptable. Some policy makers and community leaders may believe they can "teacher proof" the curriculum if they have the perfect resources. The problem with this thinking is that classrooms are complex, living systems, not assembly lines, and there is not one method or particular content that is going to *make* students achieve.

Impact of curriculum

Aligning the curriculum to your state standards and benchmarks and/or the National Common Core Standards is an important first step to increasing student achievement, but it is only the first step. For the curriculum to have the greatest impact, it should meet the needs of the individual learner and be tied to ongoing formative and summative assessments.

Individualization and personalization are two methods that are used to meet the individual student's needs. An individualized curriculum is one that is tailored by the teacher to assessments of individual students' interests and abilities. With a personalized curriculum, the student takes an active role in the "personalization" of his or her own learning. The difference, then, between individualization and personalization is in the locus of control. Is the curriculum and instruction actively controlled by the teacher or by the student?

Technology is making both individualization and personalization much more manageable. Teachers are now finding ways to individualize the curriculum for each student in ways that would be too cumbersome without technology. A traditional curriculum is delivered to all the students in the class at the same time and in the same way, without regard for what a student already knows and can do. Some students find the content too challenging because they do not have the appropriate knowledge or skills to embrace this new learning. Other students find the content boring or superficial because they have already mastered this learning. With universal access to technology, students can easily be assessed, start individualized instruction at their current level of understanding, and progress through the curriculum at a pace that is suited to their individual needs. In this way the learning needs of all the students are met and they are all maximizing their learning potential.

When teachers allow students to personalize their own learning, the role of the teacher really begins to shift. Students can follow their own interests, pre-assess

their knowledge and skills, and then follow their own learning paths in order to maximize their learning in the most efficient ways.

Regardless of whether an individualized or a personalized method is being employed, it is important to have a variety of strategies for assessing the impact of curriculum and for maximizing learning. Students' and teachers' learning to making informed decisions based on credible data generated by assessments is essential to continuous improvement and is no longer separate from the learning process, but rather an integral part of it.

Traditional assessments are summative in nature. This means that the assessment is used at the end of a unit of instruction to determine whether a student has met a particular standard. State standardized tests are also summative in nature. Summative assessments have their place but are of limited use in the ongoing learning process.

A benefit of a management tool is that it permits ongoing assessment of the student. Students can very easily be pre-tested and then guided toward an appropriate path of instruction. Students can also be assessed throughout the learning process to provide immediate automated feedback, then evaluated in a summative way upon completion of the instruction.

Formative assessment, on the other hand, takes place continuously. The intent of this type of assessment is to inform the teacher and students of gaps between what students know and can do and what they are expected to know and be able to do. The great benefit of formative assessments is that students are provided with continuous and immediate feedback that can be acted upon.

Technology can be used to incorporate assessment into instruction in novel ways that enable the teacher and student to monitor day-to-day progress accurately. Most learning software, whether it is a game, a simulation, or a worksheet, provides the student with instant feedback. Assessment data are also instantly accessible to the teacher to use as they guide the learning. Clickers and text polling are another way technology is providing instant feedback in the classroom. This kind of assessment supports the learning process instead of only assessing the learning outcome.

Technology and curriculum integration

Technology is present in almost every educational environment in the country, but it is often integrated into instruction only in superficial ways. According to the Project RED research, only 1 percent of technology-rich schools are implementing technology properly. Even in one-to-one technology environments, students often use their computers only for word processing or to conduct simple Internet searches for information. These are first-order changes, such as typing instead of writing. A learning platform that supports innovative curricular resources offers so much more opportunity for learning. And second-order changes support students to learn more efficiently and effectively.

There are a number of ways that technology can play a meaningful role in the curriculum and be integrated into instruction seamlessly. Content can be in a digital format, technology can be used to deliver content, and a wide variety of digital tools can be used to deepen the learning experience and achieve academic goals.

Digital content

Digital content is available from a variety of sources. Textbook companies have created digital textbooks that include opportunities to extend the learning through Web links, videos, and other interactive resources. Digital textbooks usually also include assessments that can provide immediate feedback to teachers and students.

There is a great deal of free content available online. The challenge may be, however, that there is so much content available that it is sometimes difficult to find good content. Another major obstacle is that it takes an immense amount of time to find appropriate content and to organize it into a coherent scope and sequence. Free content may or may not be standards based, be provided at appropriate reading levels, include appropriate assessments, or be vetted for accuracy, for example.

Some states, private organizations, and even school districts are developing banks of teacher-created lesson plans and associated resources. Empire High School in Vail, Arizona, for example, has replaced textbooks with content developed completely by its own teachers.

Classroom-management systems (CMS) and learning-management systems (LMS)

A CMS or LMS allows teachers to design and deploy customized lesson plans easily. Teachers then have a central place to store course material online for access by specified classes or students in the future. The tool allows teachers, students, parents, and administrators to view the learning path, track progress against the learning path, and review individual records of success. The system is available 24/7 from any location with Internet access, and many users can access the content simultaneously at any time.

Another benefit of a management tool is that it permits ongoing assessment of the student. Students can very easily be pre-tested and then guided toward an appropriate path of instruction. Students can also be assessed throughout the learning process to provide immediate automated feedback, then evaluated in a summative way upon completion of the instruction. The teacher, students, parents, and administration can track and analyze learning results over time and use this data to further personalize learning for each student. Entire lessons can be captured live and replayed by students who need further study or experienced by students who were absent that day.

One potential downside, however, is that once a management tool is implemented, the district or school must keep content current. Some parents and students, for example, will check their grades and assignments every evening. If these things are not up-to-date, the effectiveness of the system will be undermined.

Digital tools for learning

There are many digital tools readily available for use in the classroom. Many of them provide innovative tools that enable students to express themselves and demonstrate their understanding of the content. Audio, video, animation, design software, visualization, simulations, and modeling packages as well as email, blogs, wikis, message boards, streaming media, etc. allow students numerous avenues for creating, communicating, and collaborating. Without continuous access to the Internet, however, access to some of these resources may be limited to the software the district has purchased and to the availability of computing devices for students' use. When students are able to integrate mobile technology with continuous access to the Internet into their learning, they have an almost endless supply of Web-based resources at their disposal.

Teachers often voice concerns about allowing students unfettered access to all these resources. It is possible that this stems from the teachers' fear that they do not understand how these programs work. Many of these tools are intuitive for tech-savvy users. Students are comfortable with them, and teachers can rely on that expertise. When teachers are comfortable giving some control to students, they find that doing so excites students and often motivates them.

Student training

Metacognition is the ability to think about how you think or an understanding of how you learn. It is important for students to learn, but it is often overlooked. Many students believe that the ability to learn is fixed: that they have a certain amount of intelligence, and that their level of intelligence dictates the outcomes of their studies. One key to academic success is the student's understanding that learning develops over time. When a student becomes self-regulated, they become conscious of the learning process and develop the strategies they need to apply to various learning situations in order to be successful.

Effective learning involves a series of clear steps. First, students must plan for the learning at hand. This includes setting goals, considering resources, scheduling time for investigation and study, and creating a plan of action. Second, students must monitor their progress along the way. Finally, they must be able to adjust their plans as they progress. Learning these skills leads to higher student achievement.

The last piece of the metacognitive puzzle is that students need ample opportunities to practice these skills. Monitoring oneself and the ability to adapt according to feedback are not simple activities. These skills will develop over time, but only with practice.

Management systems, as well as many other software programs, can help students learn these skills without overburdening the teacher. At the same time, these tools provide many opportunities for teachers to model metacognition as they hone their pedagogical repertoires in e-learning environments. Goal setting, action plans, timelines, and periodic assessments all can be created and monitored within these programs. Most of this can, and should, be created and monitored by the student, with oversight by the teacher.

> **"A widening gap has formed between the knowledge and skills students are acquiring in schools and the knowledge and skills needed to succeed in the increasingly global, technology-infused 21st-century workplace."**
>
> **— Partnership for 21st Century Skills**

Parental involvement

According to a report by Louis Harris and Associates, teachers believe that strengthening parents' role in their children's learning is a task that should receive the highest public-education-policy priority. Elementary schools have traditionally been successful in involving parents in the learning process. As students move into middle and high school, however, parents tend to be less involved in the school and their children's learning.

Research shows that family involvement promotes students' success. According to the National PTA (www.pta.org/family_school_partnerships.asp), students with involved parents are more likely to:

- earn higher grades and pass their classes
- attend school regularly and have better social skills
- go on to postsecondary education

Collaboration among families, schools, and communities is even more powerful. When families, schools, and communities work together:

- student achievement improves
- teachers' morale rises
- communication increases
- family, school, and community connections multiply

Many schools are engaging parents by providing them access to the district network to monitor their children's academic progress. More-robust online environments can be created, however, that provide opportunities for parents to do more than monitor their children's grades. When teachers are encouraged to create an online digital classroom, students and parents can access classroom resources, view outstanding work produced by other students, and interact with the teacher and other parents though a parent forum/community.

In these environments, parents are taking a more active role in the education of their children. Creating a parent portal to your digital classroom can provide parents with the convenient access they desire while freeing teachers and administrators from many informational phone calls and emails. In several pilots, non–English-speaking parents who had been hesitant to engage with the school, because of language barriers, used online translation tools that their children taught them to use on their laptops. They could communicate with the school, and thus a group of parents who had previously been disenfranchised were able to engage.

This type of parent portal also enables communication between parents and teachers in an accountable and open manner. Parents can also connect with one another and facilitate a parent support network.

Preparing students for the 21st-century workforce

American school districts are concerned about the curriculum they develop and the role their curriculum will play in preparing their students for the future. According to the Partnership for 21st Century Skills, "a widening gap has formed between the knowledge and skills students are acquiring in schools and the knowledge and skills needed to succeed in the increasingly global, technology-infused 21st-century workplace."

Many of the skills identified by the partnership are not new. The idea, for example, that students must develop learning skills that enable them to think critically, analyze information, communicate, collaborate, and solve problems has been around since Socrates. The difference, however, is that in our 21st–century, global environment, students can acquire these skills in more efficient and innovative ways through the use of digital technologies.

In our global environment, it is no longer adequate or even acceptable for students to simply acquire information and learn basic skills. We have immediate access to more information than we could read in a hundred lifetimes, and it increases exponentially every day. The challenge in the digital age is to be able to disaggregate information: to find credible information, understanding the influences and motivations of the author, and then apply the new information in new and innovative ways. The global environment also requires the ability to communicate effectively through a variety of media, collaborate with people from diverse cultures and viewpoints, and be able to quickly adapt to new realities. It is clear that teachers must embrace the power of technology if they are going to transform the learning environment in ways that will prepare students for success.

Technology standards for teachers

The International Society for Technology in Education (ISTE) has created a set of National Education Technology Standards (NETS) that outline what teachers should be doing.

1. Facilitate and inspire student learning and creativity

Teachers use their knowledge of subject matter, teaching and learning, and technology to facilitate experiences that advance students' learning, creativity, and innovation in both face-to-face and virtual environments. Teachers:

a.	promote, support, and model creative and innovative thinking and inventiveness
b.	engage students in exploring real-world issues and solving authentic problems by using digital tools and resources
c.	promote students' reflection by using collaborative tools to reveal and clarify students' conceptual understanding and thinking, planning, and creative processes
d.	model collaborative knowledge construction by engaging in learning with students, colleagues, and others in face-to-face and virtual environments

2. Design and develop digital-age learning experiences and assessments

Teachers design, develop, and evaluate authentic learning experiences and assessment by incorporating contemporary tools and resources to maximize content learning in context and to develop the knowledge, skills, and attitudes identified in the NETS•S (National Education Technology Standards for Students; NETS for Students). Teachers:

a.	design or adapt relevant learning experiences that incorporate digital tools and resources to promote students' learning and creativity
b.	develop technology-enriched learning environments that enable all students to pursue their individual curiosities and become active participants in setting their own educational goals, managing their own learning, and assessing their own progress
c.	customize and personalize learning activities to address students' diverse learning styles, working strategies, and abilities through the use of digital tools and resources
d.	provide students with many varied formative and summative assessments that are aligned with content and technology standards and use the resulting data to inform learning and teaching

3. Model digital-age work and learning

Teachers exhibit knowledge, skills, and work processes that are representative of an innovative professional in a global and digital society. Teachers:

a.	advocate, model, and teach safe, legal, and ethical use of digital information and technology, including respect for copyright, intellectual property, and the appropriate documentation of sources
b.	address the diverse needs of all learners by using learner-centered strategies and provide equitable access to appropriate digital tools and resources
c.	promote and model digital etiquette and responsible social interactions related to the use of technology and information
d.	develop and model cultural understanding and global awareness by engaging with colleagues and students of other cultures by using digital-age communication and collaboration tools

4. Promote and model digital citizenship and responsibility

Teachers understand local and global societal issues and responsibilities in an evolving digital culture and exhibit legal and ethical behavior in their professional practice. Teachers:

a.	participate in local and global learning communities to explore creative applications of technology for improving students' learning
b.	exhibit leadership by demonstrating a vision of technology infusion, participating in shared decision making and community building, and developing the leadership and technology skills of others
c.	regularly evaluate and reflect on current research and professional practice to make effective use of existing and emerging digital tools and resources in support of students' learning
d.	contribute to the effectiveness, vitality, and self-renewal of the teaching profession and of their school and community

5. Engage in professional growth and leadership

Teachers continuously improve their professional practice, model lifelong learning, and exhibit leadership in their school and professional community by promoting and demonstrating the effective use of digital tools and resources. Teachers:

a.	demonstrate fluency in technological systems and the transfer of current knowledge to new technologies and situations
b.	collaborate with students, peers, parents, and the community by using digital tools and resources to support students' success and innovation
c.	communicate relevant information and ideas effectively to students, parents, and peers using a variety of digital-age media and formats
d.	model and facilitate the effective use of current and emerging digital tools to locate, analyze, evaluate, and use information resources to support research and learning

Summary

This chapter addressed the following essential components of managing classroom change in an e-learning environment:

- the changing role of the teacher defined
- how to identify highly effective teachers
- digital-content decision making
- aligning curriculum with standards, technology tools
  - knowing the difference between curriculum and standards
  - knowing the place for technology integration
- the components in effectively choosing classroom- and learning-management systems (CMS and LMS)
- understanding the power of a CMS and an LMS
- the importance of developing students' skills for the new-century workforce
  - incorporating ISTE's National Education Technology Standards
- ways to engage parents/caregivers in effective, efficient use of educational technology
  - bridging home and school

Checklist

The following checklist is an inventory of actions and activities for managing classrooms for change with an e-learning environment:

☑**Identify the shift in the teacher's role from "sage on the stage" to "guide on the side."**

- Move from teacher to learner centered.
- Identify good teachers.
  - willing and able to guide the shift
  - certified, educated, and with a good command of the subject
- Choose digital content and technologies to power the shift.
- Align curriculum to standards, student outcomes.
  - Differentiate relationship between curriculum and standards.
  - Extract concepts and skills for process.
- Understand impact of new-century curriculum.
  - Provide differentiation, personalization.
  - content
    - provided in digital format
    - technological-delivery model
    - use of variety of technology tools to deepen and enhance learning
  - consistent assessments
    - formative
    - real-time
    - individualized
- Choose classroom- and/or learning-management systems.
  - Provide central repository for assignments, assessments, lessons, etc.
  - Provide ongoing formative, real-time assessments.
  - Provide immediate feedback and communication between student and teacher, home and school, etc.
  - Make plans for keeping CMS/LMS updated and current.
  - Make plans for using digital tools.
    - social media
    - blogs
    - wikis
    - etc.
- Define student-training strategies.
  - self-assessments ongoing in CMS/LMS, other
  - Incorporate metacognition.
  - included in feedback loops
- Plan for parental involvement
  - specific plans for orientation and ongoing engagement
  - Use CMS/LMS.
  - Use social-media tools.
  - Use district portal, emails with teachers and administrators.
  - access to students' progress, assignments
  - included in feedback loops
- Strategies for integrating 21st-century-workforce skills within curriculum
  - Address each of the ISTE National Education Technology Standards.

Chapter 8: Assessing Instruction and Improvement

It seems obvious that teachers and administrators should use data to aid in their decision-making process, but this becomes challenging, as they are confronted with a wide variety of complex data that they must use to make informed instructional decisions.

Data-driven decision making

To improve student achievement, teachers must set clear standards for students to achieve and identify how they will demonstrate that they have met these standards. When teachers assess students' performance carefully and adjust instruction to meet the learning needs of each student, students' achievement and teachers' effectiveness increase.

The No Child Left Behind Act has been successful in driving teachers to use data to inform their decisions about instruction. The act requires not only that states develop annual assessments to measure students' progress but that educators use data to help improve the learning of all students. It seems obvious that teachers and administrators should use data to aid in their decision-making process, but this becomes challenging when they are confronted with a wide variety of complex data that they must use to make informed instructional decisions.

There is a growing belief that educators are not prepared to analyze various data sources adequately or to think critically about the relationships between instructional practices and student outcomes. So how does a school make sense of the state standardized test-score data and the data teachers collect through unit tests, group projects, and other formative assessments? These data become meaningful only when they are transformed into actionable information.

Technology can aid teachers and administrators in transforming data into actionable information in several ways. Whether it is by organizing raw data into information that is aligned with state standards and benchmarks or by providing teachers and students with immediate feedback on classroom digital formative and summative assessments, technology provides solutions to making sense of data and makes it easier to use data to drive instructional decisions. Both summative and formative

assessments provide data that are important to the learning process. If you rely too much on one or the other, however, you will not glean the information necessary to gain the full picture of what students know and can do.

Summative assessment

Summative assessments are given at a particular point in time to mark the end of a unit of instruction. These assessments are based on given standards and benchmarks and define what a student knows and does not know. State standardized tests are an example of summative assessment, but summative assessments are also used at the end of classroom units of instruction and are an important part of district and classroom programs. Summative assessments at the district or classroom level are most often used for grading students and assigning them to appropriate classes in the future.

Summative assessments become far more efficient and inexpensive with the aid of technology. Online assessments use a computing system to create, store, deliver, and score test items. These functions are frequently performed by a learning-management system (LMS) or a more specialized testing system. Higher-end systems may also allow a teacher to select from test items based on a specific state standard to create their tests.

A relatively new but promising area is online essay grading, in which the software can grade a student's essay or open-ended response. The system can also provide suggestions for improving the student's writing.

Standardized testing involves many expenses, whether the test is executed with paper and pencil or through a digital medium. Some of the fixed costs are standards setting, equating and scaling, item formation, and independent psychometric review. Variable costs include printing, packaging, distribution, scanning, storage, disposal, and scoring. It is in these variable costs that tremendous cost savings can be made.

The estimate of the cost of online testing in Michigan, for example, was $5.90 per student versus $9.70 for the traditional paper-and-pencil method. This may not seem like a substantial difference, but when you multiply it by the 1,450,000 students who take the test in Michigan every year, the state could save $5,510,000 a year. An additional important benefit is that schools could receive results within 48 hours, instead of the months it currently takes, which render the results almost useless.

Summative assessments are important, but they evaluate only the end result of the learning process. Because they are administered after the learning has taken place, they provide important data for evaluating the effectiveness of the classroom instruction, the proper placement of students within a program, or the effectiveness of a program itself.

Formative assessment

Unlike summative assessments, which happen at the end of an instruction unit, formative assessments are part of the instructional process. Formative assessment can be ongoing and provide immediate feedback that can be used by the teacher and/or student to adjust instruction while the learning is happening. This immediate feedback empowers the student by letting them know immediately where there are problems in their thought process and provides opportunities for the teacher to guide the student in the right direction as they learn the concept or skill.

In their article for the National Middle School Association, Catherine Garrison and Michael Ehringhaus describe formative assessment as a type of "practice" and suggest that teachers should not grade students on skills and concepts in the introductory stages of learning.

"What if, before getting your driver's license, you received a grade every time you sat behind the wheel to practice driving? What if your final grade for the driving test was the average of all the grades you received while practicing? Because of the initial low grades you received during the process of learning to drive, your final grade would not accurately reflect your ability to drive a car. In the beginning of learning to drive, how confident or motivated to learn would you feel? Would any of the grades you received provide you with guidance on what you needed to do next to improve your driving skills? Your final driving test, or summative assessment, would be the accountability measure that establishes whether or not you have the driving skills necessary for a driver's license—not a reflection of all the driving practice that leads to it."

Unlike the question-and-answer method used in summative assessments, formative assessments can take many forms. They can be performance assessments, for example, in which students have to demonstrate the practical application of the knowledge. They could take the form of a play, an artwork, or a song that demonstrates

students' understanding in creative ways. Or they could even take the form of a digital question-and-answer test that provides instant feedback and elaboration of the questions that students answer incorrectly. Good teachers employ these assessment strategies and many others. The important thing is that the formative assessment provide information to the teacher and students and use that information to enhance learning.

The use of technology in formative assessments is not limited to interactive tests. Students can use technology to design and generate a host of dynamic, creative processes and products to demonstrate their learning. What is important is that formative assessments allow students to use their creativity, empower them with choices, and provide them with opportunities to apply their understanding to real-world situations. Technology also makes is easier for teachers to use project-based learning strategies that can lead to higher student engagement while providing meaningful feedback to the teachers (and students) about what students know and can do.

The ability to collect, organize, and analyze data, then turn them into actionable information is possibly the most important thing a school and district can use to guarantee long-term, sustainable improvements.

Differentiated instruction

Differentiated instruction is an instructional approach that also capitalizes on students' creativity, empowerment, and demonstration of knowledge. Children grow and develop at different rates, have different interests, and have different strengths and weaknesses. When a teacher teaches the same thing to the entire class at the same time, it is likely that a third of the students already know the content. Another third of the class will learn it. The other third may not have the knowledge base and skills required to understand the content and will therefore not learn it. In this scenario, a third of the students are actually learning.

Differentiated instruction is a student-centered approach that attempts to reach all students by offering many pathways to learning. The strategy is based on good assessment practice. It provides two entry points for learning: students' readiness and students' interest. A student's readiness is addressed through carefully targeted strategies based on the teacher's assessment of the student's abilities. A student's interest is addressed through the options, or pathways, the student can use to learn.

There are also three "modes" that can be differentiated in the classroom: the content, the activities, and the products. The content refers to what the students will learn. This can be adjusted according to the assessment of a student's readiness. The activities refer to the opportunities through which students will process new concepts and skills.

Providing students with many pathways for exploring new content and allowing them to choose the pathway they like helps differentiate instruction. The products refer to how students will demonstrate what they have learned. Allowing students to be creative in choosing the way they demonstrate what they know and can do also contributes to differentiated instruction.

Teachers can differentiate the learning environment so that it is flexible and appropriate for all students, although they may be doing different kinds of work at the same time. Teachers may have to create a space where some students can work quietly without distraction. Others may require space to work collaboratively. The key to making this work is for the teacher to create a safe and inviting atmosphere in the classroom and to set clear guidelines and routines when students are working independently or in collaborative groups.

Mobile computing devices with continuous access to the Internet for every student can help support the transition from a teacher-centered to a differentiated learning environment. In this one-to-one environment, students have freedom of location: They can work in small groups, individually, or in large groups, inside or outside the classroom, and the teacher has more time for one-on-one interaction with students.

Teachers often fear that they will have to create a separate lesson plan for each student if they are going to differentiate instruction. Technology is a powerful tool that can also help personalize instruction. The first step is to assess students' readiness, abilities, and interests and then use this data to guide instruction. There are many online tools and software programs that can be used for these assessments. Teachers can set up online interest surveys through free online survey tools. The National Center on Student Progress Monitoring provides information on progress-monitoring tools that track and chart students' progress over time.

After teachers analyze the assessment data, they can set up flexible groups based on a number of things, such as abilities and interests. Students can then work through digital content and process new concepts and skills with an array of digital tools that are fun and engaging. There are also a wide variety of digital options that allow students to explore their creativity. Furthermore, tools, such as wikis, blogs, social-networking sites, email, and Google docs, provide opportunities for students to collaborate in meaningful ways not only in their own classroom, but also with students and professionals around the world.

Finally, by using technology to differentiate instruction, teachers promote 21st-century skills and provide opportunities for students to develop digital literacy as well as inventive thinking and effective communication skills. The bottom line is that integrating technology into the differentiated classroom helps personalize instruction, enhances learning with multimedia components, and can help engage and motivate students.

Personalized learning

Personalized learning takes the idea of differentiated instruction a step further. It is

Personalized-learning model

The major components of this model are based on several researchers' findings from 1986 to 2000. They include:

1. ***Comprehensive assessment of the student's knowledge, skills, interests, and learning preferences***

Before teachers can develop an appropriate learning plan for a student, they must understand who the child is and what he or she already knows and can do. Just as in the differentiated-instruction model, it is important to assess a student's readiness, abilities, and interests and then use this data to guide the development of a personalized curriculum.

2. ***Parental involvement***

Children look to their parents for guidance at the start of their educational journey. Parents know their child better than anyone else and can provide valuable insights to teachers to help them develop the child's personalized curriculum. This model supports a strong collaborative relationship between the teacher, the student, and the parents.

3. ***Choices***

Personalized learning supports a variety of learning choices and opportunities both within and beyond the classroom. Choices may include more traditional things, such as the content a student will learn and the process that will be used to learn it. The choices can also extend beyond the traditional walls of the school and include the time of day and location where the student will learn. The key is that the choices revolve around optimizing a student's learning potential.

4. ***Access to technology***

Without the use of educational technology, this level of personalization would be almost impossible, considering the number of students a teacher is typically responsible for every day. When a student has 24/7 access to a mobile computing device that is connected to the Internet, he or she has unprecedented freedom of movement. Learning can take place anytime and anywhere, and students have access to almost unlimited primary resources, worldwide communication tools, and creative and collaborative applications.

5. ***Ample one-on-one teacher and student interaction***

When the personalization model is fully implemented, teachers are no longer the "sage on the stage" and do not have to spend the entire instructional period lecturing at the front of the class. Instead the teacher is free to interact with individual students and provide the one-one-one time that is more valuable to the learning process.

a blend of classroom-based and non-classroom-based learning that is tailored to the needs and interests of each individual student. In this approach the teacher, student, and parents create a learning program that will engage the student in the most meaningful and absorbing way to maximize the student's productivity and learning potential.

The personalized-learning model is the most robust, flexible, and individualized approach in education today. No other current educational model has the same level of potential to engage and motivate students, increase their productivity, and address the diverse needs of the student population found in schools today. Personalization provides all children with the opportunity to learn and be successful in their schooling.

The digital difference

It is clear from the examples in this chapter that technology can play a vital role in assessing instruction and improving student outcomes. Technology has the power to engage students in dynamic ways, provide opportunities for them to be creative, and supply ongoing and immediate feedback. The ability to collect, organize, and analyze data, then turn them into actionable information, however, is possibly the most important thing a school and district can use to guarantee long-term, sustainable improvements. To do this effectively, districts must integrate a number of data systems and find solutions that are relatively easy to use. A data warehouse is this type of solution.

Data warehousing. A data warehouse is traditionally thought of as a place where a school's data are archived. It can archive important historical data but can also be a site for managing all types of data, from business transactions to students' grades. Educators can query and run reports that can be used as information in the decision-making process.

Data warehousing is becoming an important tool to help districts mine their data, understand the information the data provide, and to be able to use them in effective ways. Because the enabling technology has been so expensive and difficult to use in the past, large corporations have been its primary users. Today, however, the price is much more reasonable, and the technology itself is relatively easy to use and is migrating online. (See Chapter 9 for information on cloud computing.)

Although a data-warehousing system can be relatively easy to use once it has been configured, it does remain a complex system to build. There are several considerations in designing the system. It is important, for example, to examine the current data systems and their platforms. It is also important to decide which data will be included and what functionality is necessary to meet the needs of the various constituents that will benefit from the system.

Report generation. Efficiencies can be gained by integrating all of a school district's data systems into one data warehouse. The power of the data warehouse, however, comes from its potential to generate reports for use in making important financial and instructional decisions. When properly configured, the data warehouse can generate a number of reports with the push of a button. These reports may include:

- trend analyses
- exceptions reports
- financial forecasting
- logistics and inventory management
- reports that compare performance versus goals

Reports or dashboards can be customized to meet the needs and expectations of various stakeholders. For example, parents want different snapshots of the data than the superintendent does. These reports and dashboards should be used as part of the ongoing communication strategy discussed in Chapter 2.

The data warehouse can also provide the ability to use the data to create models, and combine social-networking software with the data platform to enable collaborative decision making. Because the potential benefits of such a system for managing operations, tracking students' progress, and creating efficiencies that can lead to financial savings are so great, school districts should not overlook this important tool.

Data-driven decision making is not always easy to implement. Most schools and district have a tremendous amount of data that could be used to guide their instructional and financial decisions. Superintendents, principals, teachers, and other district leaders, however, have to embrace the concept, learn to use their data effectively, provide training for the rest of the staff, and formalize a plan for analyzing and using the data in an ongoing manner. It is only through such a strategic approach that schools can maximize the power of their data.

Summary

This chapter addressed the following components of assessing instruction in an e-learning environment:

- the importance of data acquisition, storage, report generation, and analysis in driving teaching and learning decisions
- the tie-in of student assessments (summative and formative) to gather data for analysis to ensure students' progress
- use of data to drive differentiation and personalization for student learning and monitoring of progress
- components of differentiated instruction
- elements of a personalized teaching and learning environment

Checklist

The following checklist is an inventory of important actions and activities for assessing instruction and improvement in an e-learning environment:

☑**Recognize that use of data must inform instructional decisions.**

☑**Mandate that data are analyzed and effectively used.**

- Identify tools, timelines to be used.
- Identify strategies for analyzing data.

☑**Outline methods of summative and formative assessment.**

- Provide for students' creativity; individualized strategies.
- Incorporate project-based learning.

☑**Include differentiated instruction.**

- Address students' learning styles, interests, levels of progress.
- ways to identify students' readiness and interest
- Focus on content, activities, and products.
- Ensure consistent access to the Internet

☑**Design an environment for personalization of teaching and learning.**

- comprehensive assessment of the student's knowledge, skills, interests, and learning preferences
- parental involvement
- choices
- access to technology
- ample one-on-one time for teacher and student

☑**Plan for digital warehousing.**

- Plan for generating and using reports.

Chapter 9: Employing a Sustainable Infrastructure

As school districts develop their educational-technology programs, add companion devices, and move beyond the physical walls of their buildings, they should plan at the same time for the technological infrastructure needed to support these initiatives. An infrastructure is the basic physical and organizational structure necessary for the program to function and includes the devices, laptops or tablet PCs, software, wired and wireless networks, servers, storage, and other devices that are needed to support the services managed in the data center as well as the components that are managed in the cloud, plus the support to keep it all going.

The sum of the components is far more than a simple compilation of the individual parts, and the infrastructure will consume the largest portion of a project's budget. Of major importance are:

1. learning and teaching platforms (client devices)
2. back-end servers and storage
3. connectivity requirements
4. software for productivity, analytical capacity, and curricular digital content
5. peripherals, ranging from interactive whiteboards to science probeware
6. human capital for supporting all of the above

Learning and teaching platforms

Digital learning environments are the key to addressing the three C's of learning today:

- **Consume:** Read and interpret text and imagery
- **Collaborate:** Share what is learned and work with others to extend knowledge.
- **Create:** Demonstrate mastery of content through appropriate responses that use higher-order thinking skills

Learning platforms offer a range of integrated Web-based applications. These tools are aligned within an integrated system to serve the administrative, student, teacher, and data district needs. The platform moves the nexus of teaching and learning outside the physical school environment and permits anytime, anywhere access.

Options for learning platforms are driven by setting goals and choosing digital content, such as online and managed-learning applications. The platforms provide email, messaging, and text and video conferencing for the school community. They offer opportunities for shared discussions, documents, social networks, and other options.

Other considerations in choosing a learning platform include all infrastructure components, such as:

- bandwidth
- speed
- network
- servers
- power
- peripherals

What follows is an overview of expected platform functionalities for the K–16 sector.

High school/higher ed and teachers

- Industry-standard productivity software enables easy sharing: using IM, infrared, USB, WLAN; VoIP (real-time chat, video chat, and others), educators can collaborate while creating projects.
- full-size keyboard and screen; enhanced performance using multimedia software, podcasts, apps, multitasking, Office suite, science and data analysis, rendering, exporting, backing up
- Large screen and internal CD/DVD drive; multimedia and virus scans; AMT (extensive use of AVIs; several concurrent inputs, like Web resources, chat, AVI)
- Weight range of notebook may limit students' and parents' willingness to carry it home

7–8, middle school

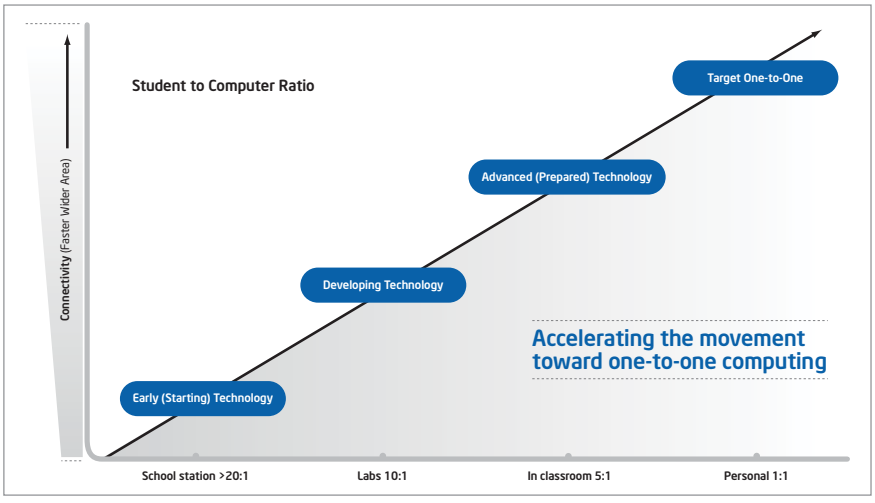
- Industry-standard office productivity software enables easy sharing: IM, USB, WLAN; VoIP, synchronous messaging (real-time chat, video chat, others).
- full-size keyboard and screen; Office suite, multimedia, science and data analysis, rendering, exporting, backing up
- more performance-intensive multimedia content via Internet or external DVD drive. Local storage possible (extensive use of AVIs)

K–6, elementary school

- Sharing of documents via USB, email (subject to Internet-based mail-attachment size constraints), and teacher-guided broadcast of student's work, asynchronous messaging (bulletin board)
- Some creation applications (paint picture, type story separately); but limited use of concurrent tools, because of lack of mass storage and performance. (MS calculator, Office, Adobe)
- Less performance-intensive multimedia content accessed via Internet or local network (some AVIs, Flash, text, and JPEG-based content)
- lightweight and rugged, permits easy portability

Computing devices

In recent years many schools have moved to a one-to-one initiative. The following diagram demonstrates education's progress toward the goal of having each student have a computing device.



Source: Blueprint Solutions Digital Content in the K–12 Classroom, Intel, 2010

America's Digital Schools 2008 showed that one-to-one programs were growing at a rate of 4 percent a year. The One-to-One Institute and Intel are compiling a national database of all U.S. one-to-one programs (in progress at this writing). It is estimated that there are 2,000 in the United States as of spring 2011.

Virtualized desktops make fixed computers an interesting and cost-effective option for schools. Computers access a virtualized server for its operating system and applications. The server is optimized for efficiency, and each desktop device has the same look and feel, from wherever the student has access.

Desktops work well in labs and libraries and as classroom computer stations. They come in a variety of options: powerful (workstations); small form factor, to save space; touch enabled; and power and energy efficient. There are now computer-sharing solutions that reduce the cost of desktop computing while expanding students' access.

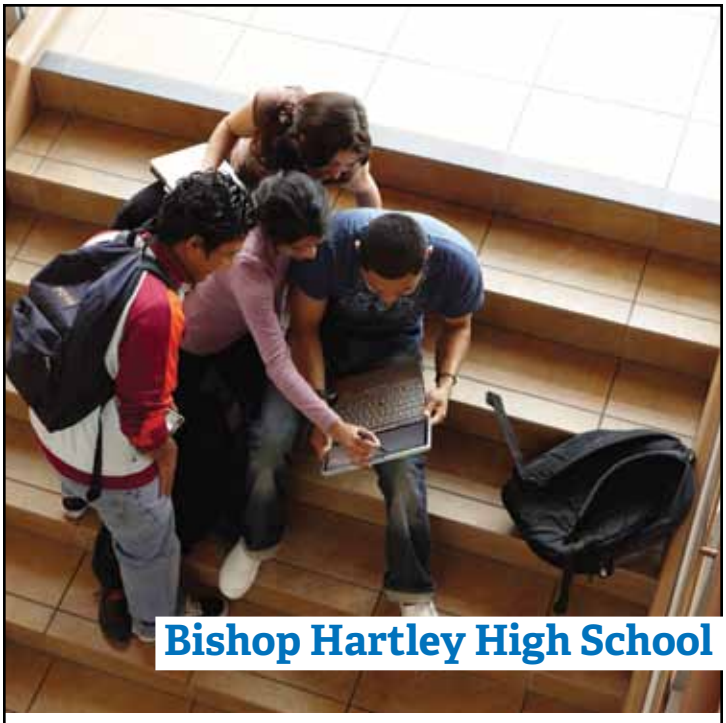
Yet laptops and other mobile computing devices are becoming more prevalent in many schools for the same reason they are plentiful in business: mobility. With mobile computing and with each student and teacher having a personal computer, students can pursue anytime, anywhere learning. Laptops allow students individualized access to resources, assignments, and assessments to shift instruction to a learner-centric model.

Today's laptops have longer battery life and are lighter in weight and more rugged. Where districts cannot provide each student his or her own device, they have rolling carts of classroom sets of laptops that provide consistent access to the Internet and network applications.

Newer computer models include the tablet PC and netbook. Tablets are sometimes referred to as convertibles because they accept typing and stylus writing. Teachers and students can be highly mobile and use the touch-screen feature to take notes, record observations, translate handwritten notes into text, and access Internet resources and later convert those notations into presentations or documents. Tablets are especially useful for field and science laboratory work but can be used across curriculum areas.

Some examples are:

- writing mathematical equations
- diagramming molecular structures in chemistry



Bishop Hartley High School

Bishop Hartley, a high school in the Diocese of Columbus, Ohio, instituted an initiative with HP Tablet PCs to help enable interactivity and individualized learning. Its objective was to provide technology that facilitated interactivity in the classroom and enabled students to learn in the way that suited them best.

The approach the diocese took was to establish a one-to-one technology program for high school students at Bishop Hartley High School. The technology improvements included a wireless mobile solution available 24/7 and a digital pen that enabled inputting content that a keyboard can't produce (diagrams, scientific notations, mathematical equations, and more).

The educational benefits the diocese realized were:

- Teachers use innovative, collaborative classroom tools and programs.
- Tablet PCs facilitate individualized instruction.
- Students concentrate on class content over delivery.

According to Ken Collura, director of technology for the Diocese of Columbus, "the tablet computer is a versatile tool for teaching and learning that can be used by individuals in ways that best suit their needs. We've been using HP Tablet PCs to deliver an excellent educational experience and excellent results."

- writing music
- foreign languages: writing Chinese or other characters
- review and editing in language arts

Netbooks generate revamped economic and management classroom models. Some do not accommodate the power intensive multitasking efforts required at the secondary-school level but are part of many programs because they are less expensive are lightweight, take up less space, expand one-to-one student access, and provide the right amount of power and functionality for elementary grades. Laptops have greater functionality, so they accommodate the multitasking, memory, storage, and retrieval expected at the secondary-school level.

Pads and slates have made a major splash in the market. These devices are primarily a platform for audiovisual media, like books, periodicals, games, music, apps, and Web content. Their weight and size lie between those of smartphones and laptops. They run a multitouch display, different from the pressure-triggered stylus that most tablet computers use. Instead of a physical keyboard, they have one that is virtual, onscreen. Some have Wi-Fi data connections for Internet access, downloading and streaming media, and installing software. Some versions have a 3G and/or a 4G wireless data connection that can connect to HSPA data networks. These devices are managed and synchronized through various Web-based applications on a personal computer via USB cable.

Life-cycle considerations

Technology is continually evolving, expediting devices' life cycles, because newer models generally offer more features at a lower cost. Yet schools can't wait forever for the "perfect" laptop to come along, because there is always something better, faster, cheaper just around the corner. Planners can take comfort in knowing that even after a particular device is no longer manufactured, it is simple to add functionality with external USB devices, such as DVD burners, extra hard drives, and other peripheral devices and options. Replacement parts are generally on hand for a long time, and getting extended warranties and accidental-damage-protection plans prevents most problems. There are also trade-in and recycling programs for when a device comes to the end of its usefulness.

Device durability

There are a number of product features designed to ensure the durability of a notebook. Look for durable and lightweight materials, such as magnesium alloy frames and display enclosures.

Another feature is the hard-drive mounting solution: how it transmits shock from the hard drive into the notebook's structure, protecting students' data from the effects of being banged and dropped during the course of a day. A third-party test lab can verify this solution.

In-Mold Lamination (IML) can provide a finish that is more durable than paint. The process embeds the finish, incorporating an accent or body color beneath a layer of polycarbonate film and then bonding it to the notebook's enclosure. The resulting scratch-resistant surface can protect the keyboard deck from normal wear and tear.

Another feature to consider is a spill-resistant keyboard with Mylar film, which helps reduce the risk of damage to sensitive critical components underneath the keyboard. Choose a manufacturer with an extensive testing process that is the basis for industry-leading fine equipment and reliable computing solutions. Its test strategy should include:

- user-scenario testing
- mobile-specific testing: wireless, power management, and docking
- third-party hardware and software compatibility testing
- interoperability testing
- qualification of new components, BIOS, software-deliverable updates (sustaining)
- Human Factors Testing: developing customer-centric products using Human Factors Engineers through simulated environments and usage observations

In implementing a one-to-one initiative or other technology-intensive programs, school leaders must take into consideration infrastructure issues ranging from the choice of mobile computing devices to wireless networking and security. Districts should consider devices that include the following features:

- lightweight and sturdy
- protective carrying case
- battery power of several hours with easy options for recharging
- wireless available with appropriate software

- sufficient storage
- flexible, having USB ports and other options for expansion

When considering whether to choose tablet PCs, netbooks and/or standard laptops or a combination of these, schools should begin with their goals and in what way each device can be the answer for their program and their instructional goals and capacities.

Back-end servers and storage

Data warehousing

Educators need access to actionable information. Yet schools may be data rich and information poor, because the various systems are often incompatible with one another. The challenge is to turn the data into information that administrators, teachers, and students can use. A data warehouse enables schools to collect and store data from various silos, such as student-information systems, assessment systems, food service, transportation, and other educational data sources. Using data-management tools, it creates useful, actionable reports.

In a data warehouse, source data are gathered, cleansed, and filtered before being stored in an integrated data warehouse optimized for reporting and analysis. This allows educators access to standard reports, creation of ad hoc reports, and complex data analysis based on correlating information from all these various sources. The data warehouse is able to maintain many years of data (students' entire K–12 records), facilitating ongoing analysis. What are some examples?

- A high school principal is able to look at incoming students and discover that one of the middle schools is providing students who are out-performing all others in expository writing; this provides the principal with an opportunity to capture a "best practice" to be replicated.
- An eighth-grade math teacher is able to see that 30 percent of her students from the upcoming seventh grade aren't at grade-level reading for the digital resources she is planning to use and is able to adapt her classroom instruction to compensate.
- The superintendent is able to evaluate the effectiveness of the district's at-risk reading programs according to other assessments and the students' demographics and to look for success factors based on the students' involvement in other, complementary programs, and better identify which children will benefit from the program in the future.
- An assistant superintendent of curriculum is able to see that a large subset of students performing below average on a portion of the state's standardized eighth-grade high school test all had the same sixth-grade teacher in one particular middle school.

Educators can access the data warehouse to monitor day-to-day learning achievement by a class, a grade, a single student, or groups of students. This can be set up for a school building, a district, or an entire state. The reporting works with historical data and so permits longitudinal analysis with standard reports or ad hoc report creation as well as complex data analysis. This can be the basis for the data-driven decision making that the NCLB legislation requires and is a technology that, combined with the educational portal, it makes sense to consider as part of a larger e-learning initiative.

Access to virtualized server infrastructure

Server virtualization—the creation of a virtual version of a server rather than an actual server—has progressed over the past several years to where it is not the norm for schools to provide a robust physical server environment. By virtualizing the server infrastructure, schools can reduce the physical footprint of the servers required to provide both administrative and learning systems. Additional benefits of virtualized servers are reduced software-licensing costs, optimized use of resources, rapid service deployment, and reduced cost of operations.

Schools should approach server architecture with a plan for virtualizing as much as possible when deploying server solutions. There are still some applications, software stacks, and workloads that cannot be applied to a virtualized infrastructure, but it is a realistic goal for schools to target 80 to 90 percent of the server infrastructure for virtualization.

The cloud

The National Institute of Standards and Technology defines cloud computing as: "...a model for enabling convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, serv-

ers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service-provider interaction."

There are three basic types of cloud infrastructures: internal, or private, and external, or public, plus a hybrid cloud, which is a combination of private and public. In an external cloud, service providers sell on-demand, shared services to a school. The package includes IT support, services, and expertise; the school must run only the provided applications and services.

In an internal cloud, servers, software resources, and IT expertise are used inside the school system to build a scalable infrastructure that meets cloud-computing requirements. Because of security requirements and concerns, many schools are exploring this private approach, in which all sensitive student and user data are stored behind the school's or district's firewall.

In a hybrid cloud, an organization provides and manages some resources internally, while others are provided externally. As an example, an organization could use a public cloud service provider for general computing tasks while storing data within its own data center. The hybrid-cloud model is catching on. Some organizations may already have made large investments in the infrastructure required to provide in-house resources. Many institutions want to ensure the confidentiality of sensitive data by controlling them within its own cloud.

Impact on Schools

Teaching and learning platforms: Servers can provide some or all software applications, operating systems, and Internet access, rather than the school having these installed and maintained on each device separately. Servers deliver on demand, as needed by the school population, to the full spectrum of learning platforms and devices. For example, a single application might be shared by hundreds of students and teachers on notebooks, tablets, and desktops.

School IT: Cloud computing enables cost- and energy-efficient centralization of school infrastructures. It takes advantage of server capabilities to adjust allocation based on demand—all invisible to teachers and students. Remote management and maintenance can save time and increase security. For instance, an application or operating system served by the cloud can be upgraded once at the server level, rather than on each individual device. Access to devices can be restricted or denied in the event of a loss or theft.

Access: Along with the greater control for IT comes increased flexibility for teachers. They can complement their curriculum and students at any time. Using cloud-based systems, teachers can provide the wide range of Internet-based software and tools quickly and easily. The one caveat is that to have access to their files and applications in the cloud, every user must have an Internet connection. Parents can have access to students' data. Cloud computing provides anytime, anywhere access for students, administrators, teachers, and IT professionals.

The top six reasons to go cloud

1. It provides a flexible, scalable, cost-effective model that does not tie schools to investments in out-of-date infrastructure or applications.
2. It offers the flexibility to meet the rapidly changing software requirements of today's and tomorrow's teachers and students.
3. It enables software standardization, a shared pool of applications for use school- or district-wide, and easier maintenance through centralized licensing and updates.
4. It enables rapid development and deployment of complex solutions without requiring in-house expertise.
5. Through a pay-as-you-go model, it can eliminate the upfront financial burden of deploying new technologies.
6. It supports many client platforms both inside and outside the school infrastructure.

Servers

Most schools and districts already have servers that they use to support payroll, federal and state compliance, etc. When a large number of teacher and student clients enter the environment, the need to build server capacity to support computing and to provide storage for content and students' artifacts emerges.

The computing continuum

Not all computing or storage has to happen on client devices. It may be desirable or necessary for some activities to occur on a server. Think of the computational activity along a continuum between the client and the server. How much actually occurs on the client device versus how much occurs on the server can vary greatly from application to application. Moreover, as computing devices continue to expand, one must carefully consider the ever-changing computer continuum.

The rise of new generations of devices including handhelds, smartphones, slates, and tablets will open new opportunities for learning and teaching platforms. As new form factors emerge over the next generations of devices, platform performance and power consumption will improve. Most newer-generation platforms today are used as secondary or companion devices, and the PC is the learning and teaching platform of choice. Today's PCs offer the most stable, secure, and varied operating systems, productivity, and educational applications available.

However, schools can consider how new devices will supplement and in some situations offload functions traditionally reserved for PCs. The software requirements of students, teachers, administrators, and staff will determine the platform and computing requirements. Continually increasing hardware performance drives the development of enhanced software, which in turn drives hardware enhancement.

Districts musts analyze platforms, form factors and performance requirements to guide current and future deployments of client technologies. Finally, there are solutions under the umbrella of dynamic virtual clients, much like the virtual desktop, that enable easier management of clients on the network.

Connectivity

Bandwidth

Many factors make a program successful, and one critical need is sufficient Internet bandwidth to support the number of devices used in schools and elsewhere. Bandwidth is a measure of available or consumed data communication resources expressed in bits per second or multiples of it (kilobits per second, megabits per second, etc.). Current Internet capacity is roughly 10 kilobits per second per student, and this must grow tenfold to serve a one-to-one environment effectively. Having sufficient bandwidth throughout districts and schools can be expensive, and a district has to plan for financing this investment so that it continues to grow as the need for more bandwidth grows.

Wireless connectivity

Early telecommunication networks depended on wires in their infrastructure, but today's robust systems rely on wireless transmissions for many practical reasons, such as preventing the removal of asbestos inside walls. Thus wireless networks, versions of the standard 802.11 protocol, are prevalent in schools. Many schools still use 802.11b or 802.11g but many are moving to the state-of-the-art 802.11n networks, which support strong e-learning programs and many megabits per second per student better.

Wi-Fi is a trademarked name for a standardized set of wireless-networking protocols or standards that are issued by the Institute of Electrical and Electronics Engineers. Wi-Fi is used for the last link in the network connection. Instead of an Ethernet cable running from the wired system in the wall to a laptop, the Wi-Fi connection is made from a base station or wireless access point that is plugged into a school's wired Ethernet network and the signal sent to the laptop's internal antenna. A single wireless access point can connect to 15 to 60 laptops, depending on the expected bandwidth requirements of the laptops and the capabilities of the access point.

For anything more than the simplest wireless networking, a school has to engage a qualified designer to ensure adequate building coverage and sufficient bandwidth for expected uses. These standards have a maximum radius of about 300 feet in the best conditions. The actual usable range may be reduced, depending on construction materials and other appliances in use in the building. The 802.11b/g standard operates in the unlicensed 2.4-gigahertz frequency, the same as do microwave ovens and some wireless telephone handsets—both of which have unexpectedly turned out to be sources of interference.

Wireless security

Security for a school's wireless local area network (WLAN) is determined partly by how planners view the situation. One school IT director, after the WLAN was isolated from the sensitive data and applications, said, "It's the community's WLAN. Why shouldn't I leave it wide open? And if a

student wants to sit outside the building after school and surf the Net, there's nothing wrong with that." Others will take the opposite view and want to lock it down as tight as possible and make it invisible to the outside world. To reach the target of consistent access that enables teaching and learning to occur, the network must be available, accessible, robust, and safe.

There are a number of security technologies that encrypt the transmitting signal, such as WPA (Wi-Fi Protected Access). In addition, you can encrypt the data itself with SSL (Secured Sockets Layer). Many standards-based approaches to network-access security can coexist, including 802.1X, Web-based authentication, and wireless data privacy with VPNs (virtual private networks). In addition, enterprise-class network switches can recognize a user and the types of services and access they are authorized to have. This stops unauthorized traffic before it can cause harm.

The most secure method is to limit access to those who require it and lock out all others. The wireless access points should be outside the firewall and require VPN to enter. If that's outside the capabilities of your school, you can implement WPA encryption and watch for rogue wireless access points being attached to your network.

The Alvarado (Texas) Independent School District has moved forward with a community Internet kiosk solution. Many homes do not have Internet access. District leaders created a unique plan as a next step to bridging the digital divide.

Software: for productivity, analysis, and digital content

Software applications

Districts establish standards for foundational applications that IT staff need for the operation, maintenance, and manageability of the laptop as a device. However,

Case Study: Alvarado Independent School District

Alvarado Independent School District is a leader in educational technology in the state of Texas. It is a showcase site many districts have visited to view recent advancements and developments in educational technology. Alvarado ISD's educational-technology profile:

- 90% of all classrooms have mounted projectors
- 90% have document cameras
- 90% have interactive-whiteboard technology
- Every student in the fourth, fifth, and sixth grades is issued a laptop

More grades are scheduled for one-to-one in the coming year. Because students are being issued laptop devices, the need for connectivity outside the school building has grown greatly.

However, many homes in the school community lack Internet access. District leaders partnered with the city to create "community Internet kiosks." To bridge the gap, Alvarado Independent School District, the city, and numerous business partners developed these community-based Internet hot spots to allow anyone to gain free access to the Internet and district resources. This program is called CLICK: Community Located Internet Connected Kiosk. A kiosk screen features advertising for local companies. This helps connect the community to its businesses while bringing revenue into the district to offset the monthly wireless costs.

The kiosk, a.k.a. hot spot, looks like a stand-alone ATM machine and requires only an electrical outlet to run. A Verizon wireless broadband router is provided. The machine is Alvarado ISD branded and has a dual display with full PC function and access to the Internet and district resources. The kiosks are located in grocery and retail stores and restaurants. Businesses benefit from it because of increased traffic and people spending time in the setting.

Alvarado ISD's demographics:

- 3,400 students
- six campus locations (three elementary, one intermediate, one junior high, one high school)
- 96 square miles
- approximately 75 percent economically disadvantaged

www.alvaradoisd.net/

even when students and parents are the ones purchasing devices, they should consider a single set of mandated titles. A lack of consistency will drive up support costs, make it impossible to restore a hard drive image, and make it difficult for the teacher, who will not be able to plan on all students' having the same software tools. Schools will also have to standardize the productivity applications (Office suite, reference tools, etc.) and the set of instructional applications or creative applications. One solution that schools are beginning to implement is cloud computing (there is more about this in this chapter), and they see that storing applications in the cloud alleviates many of these concerns.

Client-management software

Most programs need additional staff to assist with the hundreds, even thousands, of new computers being added to the school environment. Client-management software enables the IT department to manage the influx of new devices more effectively and can be an important part of reducing the labor costs of supporting a technology-intensive initiative. Comprehensive client-management tools automate the five key functions of desktop management support: software distribution, IT asset management, remote control, PC backup, and settings and configuration management.

Anti-virus software

It is important to protect the district from outside viruses, worms, and Trojan horses when students take laptops home. Schools and districts should establish an anti-virus package standard and include ongoing updates. The virus definitions and updates should be able to be pushed to the laptop without student intervention and, if possible, without intervention by the school technology staff.

Personal firewall

Laptops should also have a personal firewall, whether it is the one that is included in Microsoft Windows or a standalone product from Norton or McAfee. These applications are intended to protect the laptop from Internet hackers and shield students' identities and privacy.

Anti-spyware is another product to consider, and like a personal firewall, it protects you from external threats. Spyware can secretly capture and transmit personal information, make unwanted changes to system settings, and be the source of unwelcome pop-up ads. Anti-spyware has the ability to block and to reverse the effects of these types of intrusions.

Device management and tracking

There are network tracking tools called network device management programs that support network administrators' tracking of moves, additions, and changes to the hardware infrastructure of a network. They can keep track of all network devices and provide reports of all configurations to the network since it was first put into use.

A network tracking tool provides access to an inventory of network devices, schedules device scans, and compiles periodic reports on the status of each device. An advantage of using these services is the optimization of productivity, which allows the network administrator to manage devices centrally, automate IT processes, and enhance auditing accuracy and efficiency.

A major benefit is being able to track devices to recover stolen computers and reduce the risk of computer theft. Further benefits provided by companies such as Absolute Software include the reduction of costs, through optimizing existing programs, eliminating the need for added infrastructure components, and lowering energy costs.

In geo-fencing technology, IT administrators use GPS or Wi-Fi technology to track the district's assets on an Internet map. They create predefined areas (geofences), apply rules, and receive alerts if a device strays outside the "fenced" area. This technology also enables remotely deleting sensitive data on missing computers. It can produce an audit log of those deleted files to demonstrate compliance with government and corporate privacy regulations.

Filtering software

Many districts install Web-filtering software that limits the sites that a student can visit. These applications must keep a district in compliance with Children's Internet Protection Act requirements. CIPA addresses Internet content and requires that schools that receive funds from the federal E-Rate program must install protection. The Family Educational Rights and Privacy Act (FERPA) protects the privacy of students' educational records.

All things are stored digitally today—from a district's records to students' work—and it all lives on the network. Access to information is fast, accurate, and useful as a result, but districts must guarantee that everything is protected. Security measures include the provisions made in the district's network infrastructure and policies adopted by the network administrator for protecting the network and network-accessible resources from unauthorized access.

The Children's Online Privacy Protection Act (http://searchcrm.techtarget.com/definition/COPPA) was created to protect students' rights to privacy given the tremendous accessing of information through and from the Internet. The act specifies:

- that sites must acquire parental consent before collecting or using any personal information of young Website users
- what must be included in a privacy policy, including the requirement that the policy itself be posted anywhere that data are collected
- when and how to seek verifiable consent from a parent or guardian
- What responsibilities the operator of a Web site legally has regarding children's privacy and safety online, including restrictions on the types and methods of marketing targeting those under 13. (See http://searchcrm.techtarget.com/definition/COPPA.)

There are several products, and each approaches the issue differently. Almost all have provoked controversy, pitting those who want to protect students from the dangers of the Web against those who stress personal responsibility and teaching appropriate use. These products often impose additional technical burdens on the IT staff when the software interferes with other applications or when teachers

Intel Anti Theft Technology: Educational Uses

Brick to ship

- Definition: After a system is configured by IT services, it is sent a "poison pill" to disable the platform at the system level. A custom boot message is displayed that gives a phone number to call to activate the device after receiving it in a shipment.
- Value: Guarantees that the device and shipment land in the hands of the school and are secured and activated by the rightful user(s).

Disable unrecovered devices

- Definition: A policy mandating that after all measures to recover a lost or stolen PC have been taken, it will be "bricked" after a predetermined number of days.
- Value: Renders the system useless and unsellable if it cannot be recovered. Preemptive messaging (labels, educational campaign) makes stealing laptops configured in this manner less appealing.

Disable during summer break

- Definition: Brick machines that are inactive for a long time to deter theft. Requires investigative proof of concept to determine how functional this feature may be.
- Value: Systems that are stored and/or left unattended have no resale value.

Student checkout model

- Definition: Allow students to check out devices if they know that the system can/will be bricked if not returned by predetermined date/time.
- Value: Confirms that checked-out ("loaner") systems will be returned in a timely manner or at least won't be stolen or lost.

Critical data

- Definition: Administrative or educator systems that contain personal, confidential, and state- or government-protected information need robust protection.
- Value: Encryption solutions that take advantage of Intel AT have additional hardware-level protection. Remote lock and location solutions have more options for protection, whether the laptop is connected to the Internet or not.

Theft-deterrence campaign

- Definition:proactive use of Intel AT stickers, marketing, and education to create awareness of hardware and software capabilities on devices
- Value: Education and awareness decrease the potential for lost or stolen laptops.

want to override it for specific uses or to reach specific sites. Other considerations are product updates and maintenance costs.

Increasing device manageability through hardware enhanced-features

As the complexity of learning devices increases, districts must address the possibility of rising life-cycle costs. Software is not the only solution available. Hardware-enhanced management features can provide key functionality for improving platform manageability. Over the past several years, there have been major advances in hardware that increase both the manageability and the security of desktop and notebook platforms. Two such technologies available today are Intel vPRO and Intel Anti Theft.

Intel vPRO technology adds base-level management functionality integrated at the hardware level. This technology provides traditional enterprise-management software: enhanced capability to manage PC devices no matter the circumstances. PCs that are turned off, sleeping, frozen, or locked because of hardware and software failures can still be managed remotely by most enterprise-management tools. This tight integration between hardware and software extends the reach of system managers, providing more efficient repair, recovery, and updating of deployed PCs.

Overall platform availability and repair times are greatly reduced to foster a highly available teaching and learning environment. This feature also reduces the workload of a district's IT staff because learning platforms stay up and running.

Intel Anti Theft follows a path similar to that of vPRO by extending capabilities that were often reserved for software-management solutions into base-level hardware. Anti-theft hardware features extend theft deterrence and security into a mobile PC device regardless of its operating status. Hardware can be disabled and locked to deter theft as well as protect private and confidential data. Since this technology is deployed at the hardware level, system defense and deterrence become tamper resistant and inaccessible at the operating-system level.

Disaster recovery: Back-end data-center infrastructure

The disaster-tolerance configuration depends on which services are provided. The infrastructure core generally includes servers, routers, and storage in the data center. Because the data center is essential to the program, preplanning should include taking steps to insure that the back-end infrastructure stays up and running.

The design of the supporting data center should include connecting to dual power grids, duplicate links to the Internet, and physical-access security. The configuration plan should have no single-point-of-failure or designed-in redundancy in the servers, storage, or software. In addition, districts can set up a testbed that would have a small quantity of the IT equipment that will be used to model the data center in order to test new software, patches, and updates in an isolated environment.

The production system should be tested thoroughly before changes are implemented. If the data center will support a population large enough to cost justify it or if it is deemed of a critical nature, it may be appropriate to considerwhole-data-center failover, in which another center would come online if the primary one went offline.

Peripherals and Probes

Peripherals are tools attached to but not part of a base computer that expand its capabilities. Examples include printers, mice, keyboards, scanners, microphones, probeware, Webcams, document cameras, and mobile whiteboards.

There are many powerful ways teachers can integrate peripherals within the instructional program. Teachers and students can incorporate interactive media, such as videos, vodcasts, and podcasts; scanned or photographed images; music; and interviews into digital content.

Probeware is scientific equipment that interfaces with a computer (laptop, tablet, netbook) and uses software to collect, interpret, and analyze data. Applications for probeware include measuring light, heat, speed, and other functions over time. Choices depend on instructional goals, standards, and performance objectives.

Human capital: personnel and technology support

Backup and support planning

The network that supports computing devices is just as important as the devices themselves. It must be stable, secure, and reliable and support daily operations when large numbers of users seek access simultaneously. Training for users that addresses effective network utilization,

maintenance, and troubleshooting is important. Since educators will be using the system, it makes sense that they should be able to perform stopgap interventions and day-to-day maintenance tasks.

Technology support

Technical support for a digital learning program is a key component of starting and sustaining the initiative and a core requirement of the overall plan. When any technology program is introduced, there is a spike in the number of requests for help. If those requests aren't addressed quickly and accurately, the resulting anxiety in the user community can lead to resistance.

Tech support: Who?

Planners must decide who will manage and provide technical support for an educational-technology program. Options include outside vendors, individual schools or districts, regional or state educational agencies, or blended models in which internal school staff and a centralized help center provide different aspects of support. How do planners decide? What follows is some factors to consider when weighing the options.

Accountability

Any satisfactory customer-provider relationship requires incentives for providing good service. This is true whether providers are internal or external to the district. Questions to consider include:

- Are there established service-level agreements with bonuses for excellence and penalties for subpar performance?
- Is there a clear escalation path and a maximum acceptable time for responding to problems?
- Is the support organization in question using established best practices, for example, the ITIL (Information Technology Infrastructure Library)-based IT service management reference model or other industry-recognized best practices?

Opportunity cost

Opportunity cost means the cost of not doing something so that that something else may be done. For example, if a district's internal technical-support people are expected to set up and support a new one-to-one initiative, what is it that they will stop doing? If teachers are expected to provide peer training and support for each other, what activity will that displace? If budgets are tight and districts plan to purchase technology support, what other plans will have to be postponed? When educational-technology processes are implemented, they often lessen the workload and increase efficiencies and productivity.

Technical Services

Pre-rollout technical support and disaster recovery

Disaster recovery, also known as business continuity, is not a specific product or service but an information-technology practice that addresses the need of a school or agency to create a plan of action to prepare in case disaster strikes. The plan to get systems back up and running should include a continuum of risks—from day-to-day operational risks to large-scale disasters.

Having a formal plan in place prevents the cost of systems being down. Two key questions to be answered: What is the target recovery time? What is the maximum acceptable recovery time? Some situations require zero downtime (think of NASDAQ and what its losses might be for a minute of downtime); others can survive a few minutes, hours, or even, in some cases, days of downtime.

The difference between a few minutes and a few hours of downtime can be costly. Digital learning program planners may want to consult outside experts to help them plan and design, because the culture of educational IT is generally not used to operating in a 24/7/365 environment.

The thinking that goes into the disaster-planning process yields benefits, but there should be a run-through of the steps in the plan to test them. New problems emerge, but the testing lets the staff correct the plan and test again before rolling out the system.

Building level support

There are small, cost-effective steps that a school can take to minimize the effects of failures at the individual school-building level. Planners can include additional replacements for key networking components, such as access points and switches, and store them at the building, district, or regional level. In addition, hav-

ing spare laptops will go a long way to minimize the lost time-on-task for students while their laptops are being repaired.

The number of spare laptops a school should have on hand can be calculated according to the expected MTBF (mean time between failures of your chosen device). In practice, however, this number is only an educated guess based on statistical averages. An alternative is to upgrade the manufacturers' service level with extended or upgraded warranties, which prevents having to stock an inventory of parts. It also shifts the responsibility off the school staff and onto the manufacturer, which is much better equipped to manage parts logistics. HP's Self Maintainer program is a warranty repair-service program that reimburses repairs done by a certified technician on-site.

Post-rollout technical support

Device management

Distribution process

Rolling out the program involves performing mundane tasks, such as receiving, storing, and recording serial numbers, tagging assets, and imaging or loading the school's planned software applications, even disposing of all the boxes and packing material. When there are large numbers of laptops to distribute, these tasks can overwhelm a short-staffed school IT department. The equipment manufacturer or local IT partner can take care of these tasks, either for a per-unit fee or as part of the price of a large implementation. Planners should consider what works best for their school. Is this the best use of staff time? Is this something the internal staff can manage effectively, or should the planners consider outsourcing it?

While the initial imaging of a laptop's hard drive (installing standard applications) happens before distribution occurs, reimaging is needed whenever laptops' hard drives become corrupted or the image changes from year to year. There are a number of ways to tackle this ongoing maintenance. In one method, the staff attaches the laptop to the school's network and pulls down the correct image.In another, the management software works to keep the laptops' image in a steady state and requires no intervention from staff.

Yet another plan is to have a self-service process in which the user holds down a function key on start-up and the laptop restores itself to a previously defined state. All these have pros and cons. Planners should decide which would work best for the district.

Lessons learned and best practices from schools that have implemented digital learning programs recommend the following regarding technical support, backup, and network planning.

- Implement a battery-exchange plan.
- Provide written usage guidelines and establish security measures.
- Provide on-site docking and recharging stations.
- Plan on a three- to five-year equipment life.
- Standardize hardware and software throughout a school, district, or program
- Establish technical specs based on project goals.
- Make software upgrades and imaging easy.
- Establish plans for maintenance and support.
- Install instructor workstations and management tools that permit teachers to view students' screens during class time and that make it easy for them to transmit and collect assignments wirelessly.
- Buy the best affordable machines.

Drive-restore method	Pro	Con
network HD reimaging	well-known process	large staff involvement
steady-state image management	low TCO, minimum touch	higher licensing costs
local restore	user self-service	Updating all images is difficult

Help desk

Responding quickly to teachers' and staff's problems is important because in a one-to-one program, the technology is central to the delivery of instruction. Technical problems cause stress and frustration for the teacher. Teachers have to be able to make tools work easily; a help desk is one way to address this.

Many schools and districts employ a student-support approach for help desks and other means of troubleshooting. Creative student scheduling opportunities are

unique to each school to provide time for students to help. For example, students can be assigned times within the school day to help troubleshoot across the school. Often this involves earning course credit for this work. While students provide troubleshooting techniques, they are in a position to learn strategies and intricacies involved in implementing technologies. The notion is to employ students' expertise to support uninterrupted access to technology. By arrangement and according to a schedule, students are available to respond to help-ticket requests and to give general or targeted classroom support.

Common terminology for this approach is creating a student SWAT team. An on-site educator or IT leader directs the program and enlists students who wish to form a structured group for advancing the use of technology at their school. Students increase their technical skills while assisting other students, teachers, and the community with technological knowledge and troubleshooting.

Decision points

What are the options for establishing a help/service desk?

- Will it be a generalized help desk provided to a wide base, or will it be specific to your program?
- What will the hours of operation be? A 24/7 operation will be much more expensive than one that operates during the school day. You may consider choosing a middle-of-the-road solution in which live personnel are available during the day and phone operators are available during off-hours.
- Who will be able to call? Is this intended as an escalation point for the school's technical staff, or will teachers be in calling directly? Will students and their families be able to call? The larger the audience, the more calls and the higher the level of service to your community of users, but at a higher cost.
- What is the number of devices and applications that this help desk is responsible for? Are the applications just the standard off the-shelf applications, or are education-specific and custom applications included? Keeping these numbers down will cut your costs but may also be detrimental to your users.
- What are the metrics that you want monitored in order to ensure a good end-user experience? Average number of rings before the telephone is answered, or the time before it is answered by a person? Number of callers who hang up (abandon rate)? Percentage of problems resolved on first call? Percentage of calls resolved by analyst callbacks?

These are just a few of the variables to investigate and to establish targets for.

Help-desk practices

Whatever you decide is the scope of its responsibilities, a service desk should adopt industry best practices that adhere to ITIL standards. It should be the sole point of contact for help to reduce complexity.

Having a single point of contact puts end users in control of how and when they get support. The service desk should provide a seamlessly integrated continuum of level 1 to 3 support to promote efficient use of time, better service for teachers and staff, and the measuring and meeting of service-level agreements.

Levels of support

Level 1: Includes initial response to the call and the logging of all service requests into a database but is also designed to troubleshoot and resolve most service requests to return the teachers and staff to productivity quickly. Requests that cannot be resolved quickly are routed to the appropriate Level 2 group to resolve.

Other Level 1 actions are performing password and queue resets, delivering "how to" support for shrink-wrapped and the school's custom applications, and managing call queues to see that no service request is overlooked or unresolved.

Level 2: Addresses requests that require specialized or in-depth expertise. Level 2 resources means deploying technical support personnel who possess expertise in specific problem or application areas and serve as an escalation path for Level 1.

Level 3: Designed to handle the most difficult requests, this level of service typically deals with changes in software code, environment, or scripts. As such, Level 3 service may not be provided directly by the service-desk staff. They will log, track, and manage such requests and will route them to the appropriate internal or external group, usually a senior systems engineer.

Summary

This chapter addressed the following essential components of employing a sustainable infrastructure to support an e-learning environment:

- Learning platforms, functionality, and decision making
  - important factors to consider
- Life-cycle factors for decision making and planning
  - the variety and functions of available software and programs
- Infrastructure components, dynamics, requirements
- Choosing from numerous available devices
- Student safety and security planning
  - federal law protections
  - anti-theft protocols
- Back-end infrastructure needs
- Software for productivity, analysis, and storage
  - disaster-recovery plans
- Server capacity, options
  - virtualization
  - cloud computing
- Levels, kinds of personnel technical support
  - Rollout plans, policies

Checklist

The following checklist is an inventory of important actions and activities for implementing an e-learning environment:

☑**Choose learning platforms.**

☑**Account for consuming, collaborating, and creating.**

☑**Determine device.**

☑**Identify program goals/outcomes and match them to choice of device.**

☑**Plan for device life cycle and related factors.**

- Identify durability factors.
- appropriate software applications
- client management software
- anti-virus software
- personal firewall
- device management and tracking
- filtering software
- Identify and plan anti-theft strategies.
- Understand and communicate regarding CIPA, COPPA, FERPA.

☑**Plan data warehousing.**

☑**Plan for virtualization.**

- servers
- use of cloud computing
- leveraging costs
- Assess and plan for server capacity.
- Plan for the computer continuum.

☑ **Put in place protocol for effective infrastructure.**

- bandwidth
- wireless connectivity
- wireless security

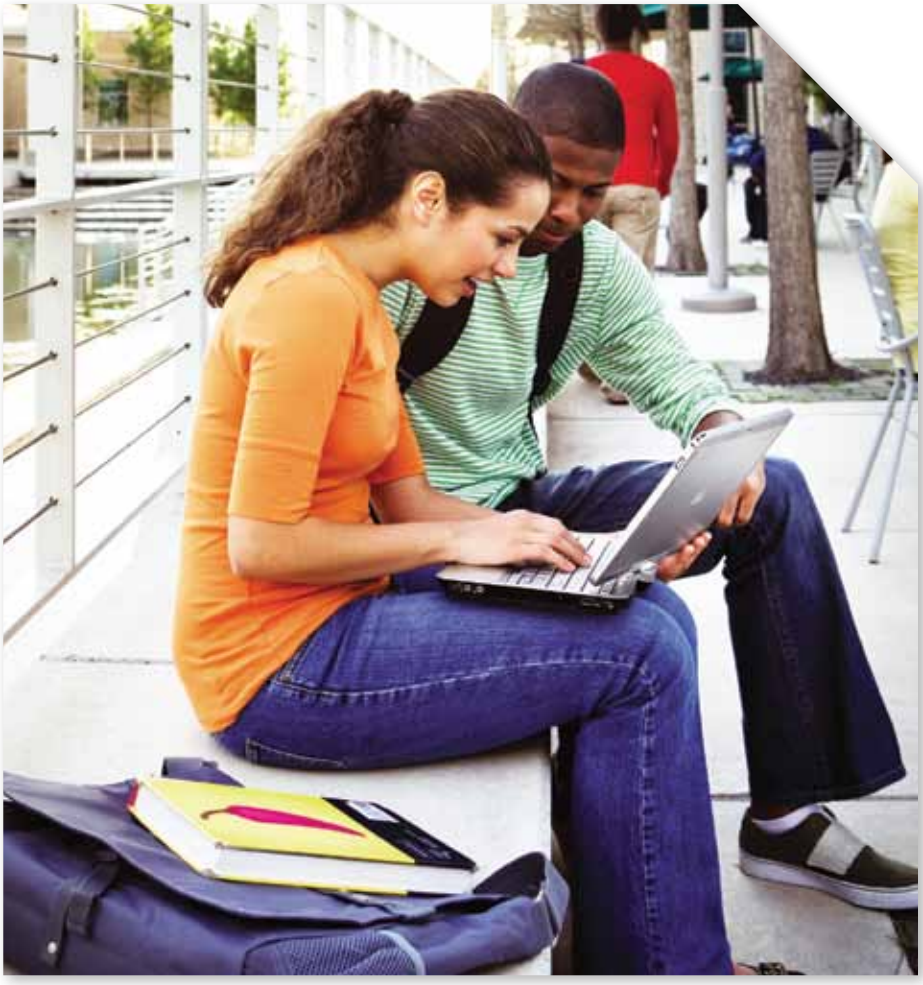
☑**Choose software for productivity, analysis.**

- Web-based applications
- peripherals
- Overall technology staff support systems
- rollout plans
- disaster-recovery plans

☑**Identify and communicate the three levels.**

- help desk
- building and district levels
- who
- how/process
- follow-up and accountability

Chapter 10: Financing Educational Technology



School leaders say that lack of funds is a major barrier to the infusion of educational technology. Current economic realities underscore the point. However, America's educational system exists to enhance students' short-term achievements while preparing them for the future.

Education leaders are charged not only with ensuring that students are prepared for high-stakes tests, higher education, and/or work but also with equipping them with the universal skills needed to flourish in a rapidly changing workforce and world.

In general, school budgets are earmarked for fixed expenses, and a mere 10 to 20 percent of general operating funds remain to pay for supplies, outside services, and technology. Schools and districts have struggled to keep initiatives up and running while refreshing and maintaining technology. All trends point to a new day for educational-technology focus and funding. At this writing, April 2011, federal legislation and funding have not yet been determined.

The National Education Technology Plan 2010 says:

"To achieve our goal of transforming American education, we must rethink basic assumptions and redesign our education system. We must apply technology to implement personalized learning and ensure that students are making appropriate progress through our P–16 system so they graduate. These and other initiatives require investment, but tight economic times and basic fiscal responsibility demand that we get more out of each dollar we spend. We must leverage technology to plan, manage, monitor, and report spending to provide decision makers with a reliable, accurate, and complete view of the financial performance of our education system at all levels. Such visibility is essential to meeting our goals for educational attainment within the budgets we can afford."

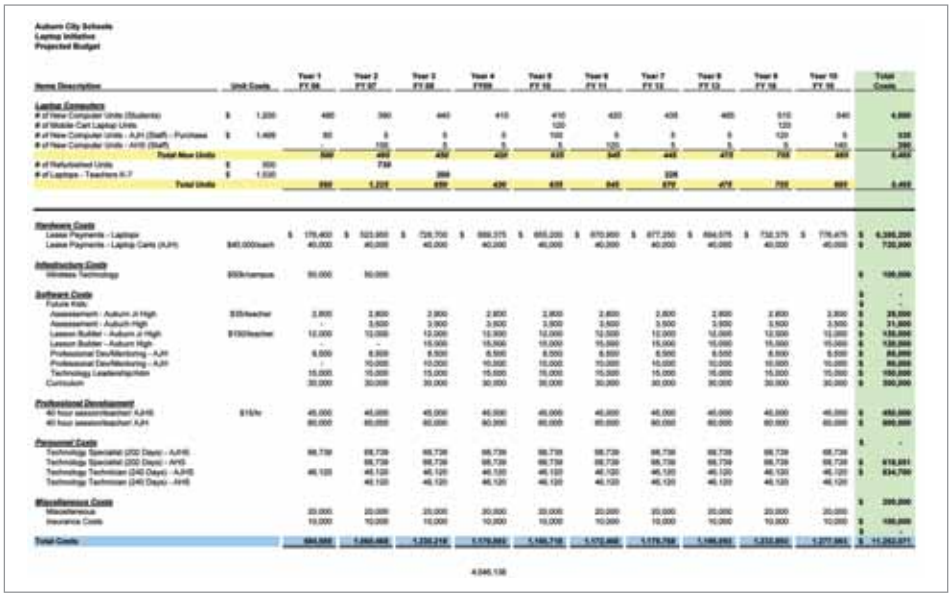
Classroom technologies are not silver bullets guaranteed to fix educational woes. They are tools that can help improve educational outcomes, increase productivity, and effect revenue-positive results when well implemented. Planning and professional learning are essential to making this happen.

As in business and other industries, it is very important for school districts to identify funding streams as part of their technology and IT plans. Defining short- and long-term goals that are aligned with strategic action plans are crucial to the planning process, and all key stakeholders have to be part of the process. Also, as in business and other industries, decision makers must think about which costs they can eliminate as they modernize. For example, if teachers are using a tool like Google Earth, the district could stop purchasing wall maps.

Still, the stakeholder community will scrutinize the costs of technology, particularly in light of local economic constraints. Strategic planning for educational technology must be viewed as a systemic solution to be integrated with curriculum and instruction, teaching, learning, assessments, data, and decision making. Technological answers must align with educational goals, programs, and desired outcomes. Building and communicating the business perspective and supporting research and best practices for technological expenditures are essential. Good, robust professional learning for educators must accompany the technologies.

Good planning also ensures that the total cost of funding is addressed. This includes not only hardware and software but also operations, human capital, licensing, and capital costs. Costs for implementing educational technology vary widely.

Project RED, a 2010 research project, determined that depending on a school's starting point, the incremental costs of a ubiquitous technology implementation, including hardware, software, professional development, training, and support, are $100 to $400 per student per year.



As a society and as an industry, we have financial and instructional-outcome incentives to guide the hard decisions. In the past, school leaders have tried to maintain instructional budgets by deferring maintenance, depleting fund balances, and asking local voters for money to maintain programs and purchase technology. By reinvesting resources and retooling legacy processes, districts are discovering the power of reallocating funds to achieve systemic educational goals through the mindful integration of technology across the school system.

Once the decision makers in a district decide on a plan for implementing a digital learning program, they have to look closely at how they will pay for and sustain it. School districts prefer funding sources that are predictable, recurring, and without risk of reduction or deletion. In today's tight budgets, most funding beyond basic operating dollars is soft money. This chapter's mission is to identify sources of funding for technology.

The budget below, from Auburn (Alabama) City Schools, is an example of a successful district budget.

Technology-transformed school environments affect a range of measures of educational success and financial variables. There are three types of financial impact:

Cost avoidance that leads to savings

- establishing more compact and efficient school-district non-instructional "business" processes via the adoption of robust human-resource, financial,

and operations systems
- establishing more compact and efficient district and building single-point student data acquisition, archiving, analysis, and distribution via the adoption of robust response-to-intervention, special-education, classroom, student, and media-management information systems that interface directly or through the use of middleware.
- adoption of free Web-based digital content to replace purchased materials

Cost savings
- Using technologies that provide less expensive ways to perform tasks, e.g., using electronic communications in place of paper

Revenue enhancements
- the additional local, state, and national tax-revenue yield from citizens who, as a result of achieving higher levels of education, earn more money and thus remit more taxes

Examples

There are many ways that districts and schools can benefit from these strategies. Many are currently in use; others will soon be launched nationally. What follows is a sample.

Digital content

Digital content provides benefits to help realize cost savings. Districts can repurpose it, access it anytime and anywhere, search with different criteria, reuse and chunk it, and tag and store it in a content-management or learning-management system where they can classify and index it. Easily uploaded and stored on USB drives, digital content can be used on demand. Users can also save on storing and shipping. When a portion becomes obsolete, just that portion will be replaced, versus replacing an entire textbook.

Web-based portals, such as ClassLink, offer cost savings. For example, in New York State, Hudson Falls Central School District provides 2,400 students with anytime, anywhere access to personalized content through ClassLink. The district has saved $40,000 by using ClassLink to monitor the use of various applications down to the classroom level. This enables IT staff to discontinue, reduce, or reallocate software not being used.

Case Study:

Philadelphia Academy Charter School

Philadelphia Academy Charter School emphasizes its commitment not only to help its students develop the skills they need to become productive citizens but also to instill a love of learning and "broaden their world beyondthe classroom."

One way the school achieves this mission is through incorporating technology into its curricula. To that end Philadelphia Academy is investing more than $1 million in its technology infrastructure. It is installing interactive whiteboards in its classrooms, for instance, has implemented a computer laboratory in the high school that supports high-end digital-photography courses, and has updated the elementary school lab.

Philadelphia Academy Charter School

Instructional-technology improvements:
- more manageable desktopenvironment
- more efficient installation of new software
- easy initial setup and maintenance: Most problems can be fixed with the click of a mouse

Financial benefits:
- cost-effective classroom technology solution
- schools' computer labs now up-to-date; even nontechnical teachers can integrate technology into the classroom easily and effectively
- Supports powerful, engaging coursework.
- Supports differentiation in learning.

The move to producing and accessing digital materials in lieu of traditional, hard-copy traditional materials is well under way. Vail Public Schools in Arizona realized a savings of $42 a student (82 percent savings), having moved from textbooks to digital content, between 2006

Hudson Falls (New York) Central School District has implemented HP SchoolCloud. "We went from managing 1,400 computers to 10 servers. We're seeing a huge savings from help-desk support and maintenance time and costs."

—Greg Partch, director of information technology, Hudson Falls Central School District, New York

and 2009, according to superintendent Calvin Baker in his August 5, 2010, Webinar. At the 2010 Florida Education Technology Conference, Jill Hobson of Forsyth County Schools in Georgia reported a drop in supplemental-materials costs per student from $79 to $19 after moving to digital resources.

Free Online and Web 2.0 classroom tools

Many districts are turning to free Web 2.0 tools and applications to save the costs of purchasing software and maintaining licensing fees. Over the past few years, teachers and students have adopted such tools as blogging, wikis, and online photo and video editing and production. They also use tools for social networking, social bookmarking, and various collaborative-learning tasks. The Digital Learning Environments Web site includes articles and lists of Web 2.0 tools that educators have found useful and an e-book about Web-based tools for learning. Visit www.guide2digitallearning.com and www.K12Blueprint.com to find this type of information.

Blended online learning

Walled Lake Consolidated Schools lies in a suburb of Detroit. Dr. William Hamilton, superintendent, set out to reduce costs while maintaining high levels of student achievement. He integrated online coursework within the traditional seat-time course setting. The district experienced 57 percent cost reduction per student per course, going from $900 to $383.

Power savings, virtualization, the cloud, and being green

Twenty-five percent of a district's power costs go to IT. Initiatives such as power management, virtualization of servers, administrative desktops, and cloud computing make economic sense because they save hardware dollars and reduce IT-management workloads. Also, moving to environment-sensitive energy-saving practice is key—going green in IT.

Because students require mobility to meet the repertoire of schooling, i.e., from class to class and then home for homework, many administrative tasks can be addressed more cost-effectively, and the full value of an investment in learning and teaching platforms realized, via managed desktops.

Power management software, like Verdiem solutions, monitor usage and shut down computers remotely. HP's solution, HP Power Assistant, does the following:

- Allows the user to set up customized schedules that instruct the PC on when to automatically shift into low-power energy-saving states.
- Estimates energy consumption based on the applied settings.
- Reports estimated energy cost, pounds of CO_2, and kilowatt hours with a click of a button..

School districts that have their own data centers have begun to virtualize many of their servers, saving money and energy while reducing greenhouse-gas emissions. The Consortium for School Networking's (CosN) Web site provides a free calculator in its green-computing section to guide districts' discovery of how much greenhouse gas they are emitting (www.cosn.org/greencomputing/). These approaches conserve space, ease IT workloads, and reduce staff costs. HP's EcoSolutions Web page provides a carbon-footprint calculator, recycling and trade-in options, and other eco tools and info: www.hp.com/hpinfo/environment/index.html

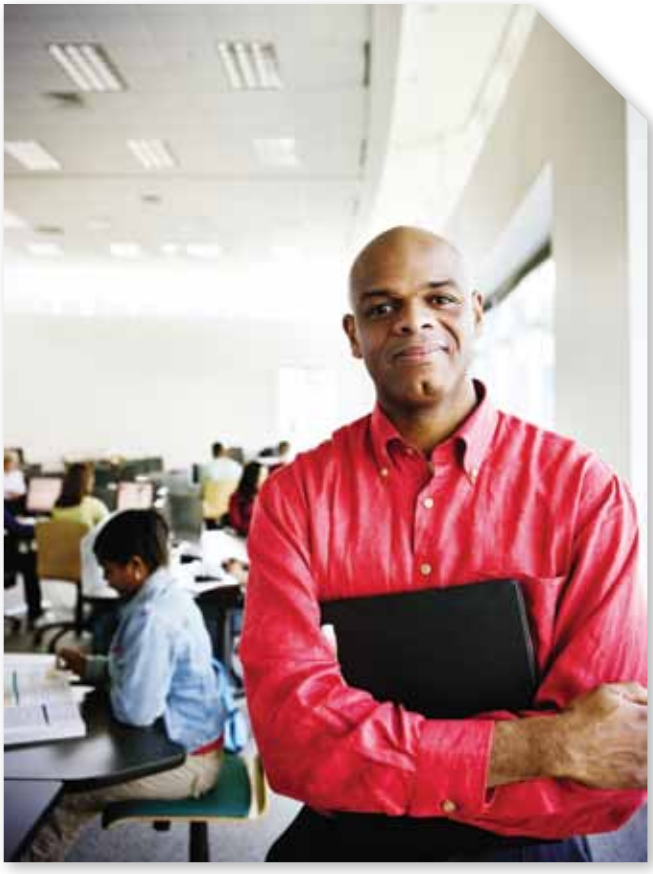
See also:

www.epa.gov/cleanenergy/energy-resources/calculator.html
www.epa.gov/climatechange/emissions/ind_calculator.html
www.nature.org/greenliving/carboncalculator/

For administrative tasks, desktop virtualization connects many users to one PC, saving up to 40 percent on the initital hardware acquisition costs and simplifying licensing for new users. Desktop-virtualization systems and simpler, newer thin-client systems can prove to have

lower initial acquisition costs and be energy effective and don't bog down the network. For example, Hudson Falls Central School District implemented HP SchoolCloud. "We went from managing 1,400 computers to 10 servers. We're seeing a huge savings from help-desk support and maintenance time and costs," says Greg Partch, director of information technology.

However, while appropriate for most administrative tasks, learning and teaching solutions that lack mobility have limitations to aspects of student learning such as doing homework; therefore, there is a diminished value of investment.



White Oak Independent School District in Texas has been using the cloud. When it hit 17 servers, the district eliminated nearly all of them three years ago and rented space across the world for all basic school functions: student-information services (Skyward), assessments, blogging (Edublog), and grade books. Michael Gras, White Oak's technology chief, reports that the district uses open-source resources whenever possible and notes that moving to the cloud has increased productivity and efficiency, reduced power consumption, and shaved tens of thousands of dollars from IT expenses.

In today's educational system, any money saved in the short term by using technology will not contribute to a school's bank account. Schools will probably spend the money they saved, given the significant shortfalls in funding. But the savings will allow schools to moderate the impact of declining or flat per-pupil revenues. The challenge is for schools to adopt technology-facilitated strategies that will enhance student outcomes (i.e., do more with the same total financial resources). As uncovered in Project RED as well as detailed the book, The Price We Pay, there are long term savings to be realized both at the state and local levels.

Funding sources

Schools receive money for technology in the following areas: federal funds, state funds, and local bonds. Federal funds reach school districts in the form of block grants through state educational agencies to local educational agencies and public schools with high numbers or percentages of low-income children.

Federal government

The federal government is a major source of school funding for the purchase of educational technologies. As of March 2011, it is recognized that major changes are on the educational-technology funding horizon.

Past practice has been that the Department of Education provides billions of dollars to local and state educational agencies through either a competitive or a formula grant process. Recently the federal government demonstrated a strong commitment to transforming education with the formal adoption of the new National Education Technology Plan. It gives a blueprint for reforming education by using technology on a grand scale.

As a result of the current U.S. economic crisis, the federal government provided Stimulus Funding (American Recovery and Reinvestment Act; ARRA) to avert myriad crises confronted on the educational front. *Education Week*'s special edition, "Quality Counts 2011: Uncertain Forecast—Education Adjusts to a New Economic Reality,"

based on an analysis of the data contained in detailed quarterly accounts from 222,000 prime recipients and sub-recipients of ARRA funding, reports, "Since the stimulus was passed in February of 2009, federal recovery dollars have flowed at an average rate of more than $12 billion per month. About one-third of all stimulus spending has been administered by the U.S. Department of Education, far more than any other federal agency. More than half of the jobs reported saved or created by the recovery program are related to education."

The Elementary and Secondary Education Act, today known as No Child Left Behind, was written to allow flexibility in using funds and included the option of allocating and combining funds from various titles to address priorities. Approval for technology expenditures is most likely when the technology is tied to NCLB goals. For example, you can use NCLB funds for technology if your goal is to develop assessments linked to state standards in reading and math for disadvantaged students; to improve teacher quality; to enhance technology integration; or to develop innovative programs that will improve student achievement.

At this writing, the 2011 federal budget that will support the reauthorization of the Elementary and Secondary Education Act has not been adopted. Proposals have remained consistent. Following are the seven sections that make up the Obama administration's proposed ESEA Reauthorization: A Blueprint for Reform:

1. College- and Career-Ready Students
2. Great Teachers and Great Leaders
3. Meeting the Needs of English Learners and Other Diverse Learners
4. A Complete Education
5. Successful, Safe, and Healthy Students
6. Fostering Innovation and Excellence
7. Additional Cross-Cutting Priorities

Key funding sources

Federal education-technology funding

K–12 schools have benefited from the Enhancing Education through Technology Program since 1994. EETT has provided direct federal funding for technology. President Obama's proposed budget for fiscal year 2011 recommends pulling apart EETT funding and integrating technology monies into a much more extensive program titled Effective Teaching and Learning for a Complete Education (www.whitehouse.gov/sites/default/files/edtech%20final.pdf).

President Obama's administration says the goal of this new program is to provide for the infusion of technology across a broader variety of programs.

Title I

The plan proposes $14.5 billion for Title I funding that will assist local education agencies with large numbers of low-income students to ensure that all learners have an equal opportunity for a good education.

Race to the Top

The 2011 budget proposal includes a $1.35 billion increase to the Race to the Top program that would flow directly to local schools to fund teacher quality and improving assessments and data systems. These funds are in addition to the $4.35 billion already committed by the stimulus package.

Individuals with Disabilities Education Act

It is predicted that IDEA will receive a major funding increase topping out at $11.75 billion in the 2011 Obama budget. These funds govern the services to students with disabilities by defining how states and local educational agencies provide interventions, special education, and other services to those in need. Funds for assistive technologies emerge from this act.

Investing in Innovation (i3)

Five hundred million dollars has been proposed for the Investing in Innovation Fund. The grant program gives money to districts and nonprofit organizations to drive development of educational reform. There are three categories for these grant monies.

1. development: grants for promising new ideas and strategies
2. validation: grants to support ideas and strategies that have demonstrated results
3. scale-up: grants to expand programs that have had results

Effective teaching and learning for a complete education

The newly proposed $1 billion program is aimed at carving out a new approach to college and career readiness.

There is a spotlight on using data for planning, decision making, and planning student progress. The program is intended to drive the shift to expectations of learners' growth and achievement instead of static test scores. It is also focused on turning around the lowest-performing schools. According to the proposal, technology will be used to serve up excellent content and will focus on science, technology, engineering, and mathematics (STEM) and literacy. Monies could be invested in online curriculum and in pioneering uses of technology for teaching and learning.

E-Rate

E-Rate is the discount for which schools and libraries may be eligible to pay for telecommunication services. Eligible schools and libraries can receive discounts of 20 to 90 percent on telecommunication, Internet, and internal connections that are needed to implement classroom technologies. Administered by the Federal Communications Commission (FCC), it is the largest stand-alone K–12 IT funding source in the country. It annually assigns $2.25 billion to facilitate classroom and public-library connectivity. Fees from telecommunication bills subsidize E-Rate. It is not part of the federal budget process.

Other sources

Other federal offices provide educational grants that offer broadband, scientific tools, networks, and classroom and laboratory infrastructures. Announced grants are aligned to each agency's unique mission and goals. Included are the Department of Commerce, the Department of Energy, the Department of Labor, the National Science Foundation, the Centers for Disease Control, and NASA.

State technology funds

Each state Department of Education provides grant opportunities to schools and districts. Some states have instituted policies and practices for simplifying procurement processes that enable sites to utilize statewide contracting and reduce overall costs for services, software, and hardware.

Issuance of local bond (i.e., school-district borrowing)

Districts can use bonds or tax increases for large-scale technology implementations, construction of buildings, and updating existing facilities. Bonds are usually funded through increases of homeowners' property-value assessments. Of course, the viability of a successful bond vote varies with each district's community. Numerous variables come into play. Status of existing structures, needs, communication of plans, and culture are several factors to be considered before going for a bond vote.

The caveat of using bond money to deploy technology is the district's ability to sustain, maintain, refresh, and scale up the program continually. Issuing a bond means that a locality is going to sell debt instruments (borrow money from purchasers) to individuals, mutual funds, money-market funds, pension funds, etc. to raise money for the project. People or organizations that buy the bonds (i.e., lend money to the school district for the project) expect to be paid back for their lending/investment activity through the district's levying taxes over a number of years to pay the interest and principle (i.e., pay off the debt with interest).

A bond is a written promise that the borrower will pay back to the lender a specified amount with interest at a fixed rate at a certain time in the future. The interest is usually paid at intervals, which are described in the bond. For school districts, interest is usually paid twice a year, and some of the principal, or the base amount borrowed, is paid annually. Issuing bonds enables a school district to:

- borrow large amounts of funds usually at a relative low interest rate compared with borrowing from a bank
- Specify the time frame for the borrowing (the period is usually no longer than the assets' real and functional life), depending on the asset (i.e., item[s] being financed) up to several decades (in some instances up to 40 years)
- determine, within limits, the amount of annual payments
- design other factors to tailor the bond issue to the district's needs

When voters say yes to a bond issue, they are agreeing to underwrite that bond. Districts levy local taxes to repay the principal and interest on the bond. Issuing bonds is a complex procedure that requires using financial advisors, underwriters, the school district's counsel, and bond counsel (attorneys versed in taxes

and other implications of bond financing). A series of financial documents, including a preliminary official statement, similar to a prospectus in the private sector, are prepared and circulated to the potential buyers. The state also must approve the bond sale. Ultimately the school board is responsible for incurring either bank or bonded debt. The voters must be convinced that this is a wise investment.

Technology financing

Technology financing, or leasing, has become popular, and districts have two options. With a straight lease, a district pays for equipment for a specified time and then returns it. With a lease/purchase, the district either owns the technology or purchases it for a very small residual amount at the end of the contract. Financing imposes fiscal restraint, as it limits expenditures to agreed-upon amounts and maintains a three- to five-year refresh cycle. Banks, local and state government pools, computer hardware and software manufacturers, and underwriters are sources of lease, or financing, opportunities. Alexandria City Public Schools in Virginia and Forsyth County Schools in Georgia are two examples of districts that have found it economically advantageous to use HP leasing options.

The advantage of financing is being able to acquire the technology without paying the full purchase price at once while still aligning with refresh cycles. Financing allows districts not issuing long-term debt to make payments from the general operating budget over a periods generally from 36 to 60 months. At the end they either own the equipment or begin a new cycle with a new program for new equipment.

Administrators and boards often find that these regular, periodic payments permit better cash-flow planning and a predetermined technology-refresh cycle and are easier to approve in an annual budget cycle. Given the pressures on district budgets, financing is a viable option unless the interest rate imputed in the periodic payment is substantially higher than the interest rate the district can earn on its operating funds. This option also provides an effective approach to having upgraded equipment refresh as old leases expire and new leases are established.

Forsyth County Schools figured out how to maximize its technology budget.

> **"Leasing through HP Financial Services is an affordable way to acquire technology, and it matches the school's cash-flow model."**
>
> —Elizabeth Hoover, Ph.D., executive director of technology services, Alexandria (Virginia) City Public Schools

Case Study: Forsyth County Schools

Like school districts nationwide, Forsyth County (Georgia) Schools is doing its best to stretch technology dollars to serve as many students as possible. It's doing so in part by standardizing on HP business desktop and notebook PCs. District leaders found a family of computers that met their needs and sought standardization based on those devices to decrease their total cost of ownership.

The system also uses financing through HP Financial Services to eliminate the need for intermittent large financial outlays and instead builds technology acquisitions, and regular technology refreshes, into the annual budget. The district is an HP certified Self-Maintainer and performs its own warranty service in-house. That applies to everything from desktops to servers. And maintenance isn't conducted just by the school system's technician employees but also by students. The district also initiated a high school apprenticeship program by means of which students completing the computer-systems class can do work and become HP certified.

Most of the district's desktops and notebooks are acquired via a three-year lease program through HP Financial Services. This ensures a regular refresh cycle.

IT benefits include:

- standardization, which reduces IT staff requirements
- Forsyth County can perform warranty work in-house.
- Guaranteed refresh cycle through leasing
- Business benefits are:
- lower costs for deployment, ongoing maintenance
- consistency in the user experience
- growing availability through use of notebooks on mobile carts

Philanthropic grants

Foundations, corporations, and nonprofit organizations

may also be good sources of financial assistance for technology in schools and districts especially in the form of grant programs. While each organization has unique priorities, districts should write proposals that address those priorities specifically. In general, philanthropic entities are interested in providing start up funds for initiatives that are clearly focused, internally supported, and financially sustainable. A good place to start investigating this source of funding is the Foundation Center (foundationcenter.org). See also HP's Global Social Innovation programs for education (www.hp.com/hpinfo/socialinnovation/education.html).

Parent/caregiver purchases:
Bring your own devices (BYOD)

New practices in many districts include school leaders' turning to parents for support and funding of personal portable student devices. While fund-raising for special projects for a school or district as a whole has always existed, a new model is to allow students use their family-acquired devices in the district, accessing a secure purpose-specified guest network.

Since many children have their own, or have access to, stereos, televisions, DVDs, CDs, MP3s, smartphones, and game hardware and software, the thinking is that some families will purchase computers and related student-edition software for student learning and that this will lower the cost to the schools of acquiring technological devices. Students can bring the devices they already have.

There are tradeoffs to this option. If parents purchase different devices, the school is left supporting many platforms. Schools can minimize this exposure by guiding the families in their plans to acquire devices. Some schools work with manufacturers to secure a group pricing that families can take advantage of.

Staff purchases

In a number of districts, school leaders are allowing staff to use their technological devices both within the school buildings and remotely in the performance of the work. That is, the districts permit staff to access school software applications hosted both on the organization's servers and the cloud by using their individual technological devices. More commonly, however, districts and schools are providing PCs for their teachers to ensure that they are standardized across the technology programs and with students' devices. Standardization of devices for staff members also improves efficiencies and IT support.

Allowing employees to use their devices at the school and to remotely access district software applications regardless of hosting infrastructure reduces the cost of providing hardware to staff and allows an individual to use the type of device with which they are most familiar.

Creative strategies

School districts have to think strategically and look for creative ways to fund their priorities. Many find that the money is out there if they know how to look for it, create it, or borrow it. A good example of this is Alvarado (Texas) Independent School District. It sells advertising opportunities through a "community kiosk program" to help provide funding for aspects of its educational-technology programs.

Current budget

Districts are beginning to look at technology costs as part of ongoing budgets. In the past the initial start-up was funded by grants or special monies; districts then had to plan for ongoing expenses.

District leaders should make sure that technology costs become a line item in the general operating budget. This should include costs for:

- repair and replacement of equipment, such as laptops, printers, servers, access points, and other hardware
- replacement of consumables such as paper and print cartridges
- adding new software for instructional, business, and technical uses
- staff development for trainers, release time, and materials
- technical support staff

Including technology as a line item is both symbolic and practical. As a symbol it conveys a commitment to technology and affords it the same status as athletics, band, and transportation. From a practical standpoint, it allows for long-term planning.

Combining funds

In the past, technology and curriculum directors didn't often have discussions about curriculum, but because they now need to procure funds, they talk about technology in terms of meeting academic priorities. Currently, district plans for the No Child Left Behind law must align technology with curriculum, and funds can be combined as well. For example, districts can create an e-learning program with funds for reading improvement so that each child can receive individualized reading instruction.

Business partnerships

Asking local businesses to help schools is fairly common practice, but some districts have honed their skills to a very profitable result. Some business partners have programs in which they will match equipment or money donated to the school. This type of program helps provide additional dollars that stretch the technology budget.

Building trust between the school or district and local businesses and the vendor community can solve challenges for both sides. For example, employers need a workforce that has 21st-century skills. Forming a partnership to provide technology to local schools helps students prepare to become effective employees. Results can include businesses' providing donations of money or equipment, hiring student interns, and providing technical experts to install, troubleshoot, or assist in other ways.

Consortia approach

Large school districts have an advantage in dealing with vendors: Because they buy so much, they can demand the best price. A strategy for small districts is to form consortia that can negotiate as one entity for better prices and services or even serve as a purchasing cooperative. A consortium can also manage network services and technology training for school districts of all sizes. For those looking to create a consortium, information from existing ones will help.

In Minnesota, the education technology collaborative TIES offers technical services, student information and administration, systems software support, transportation, and learning and technology. For some districts, the Washington School Information Processing Cooperative in Washington State serves as applications service provider and runs the student-information, financial-data, and human-resources systems.

Local foundations

Competition for grants is fierce and often limited by conditions such as location, economics, and purpose. Another way to acquire funds for technology is to connect with a foundation that's more closely tied to local priorities. For example, some districts meet with local companies' foundations to discuss targeting the foundations' giving efforts to educational technology. Districts can also create a nonprofit foundation that can do major cohesive fundraising for large-scale educational-technology initiatives.

Another idea is to engage in entrepreneurial activities, like cell-tower rentals, facility-naming rights, and beverage contracts to reduce reliance on general-fund budgets. These strategies often result in additional resources with which to pay for technology.

Dynamic Technology Planning Program (DTPP)

Using DTPP, a customized software tool, the One-to-One Institute works with a district's top-level leadership team to establish the following:

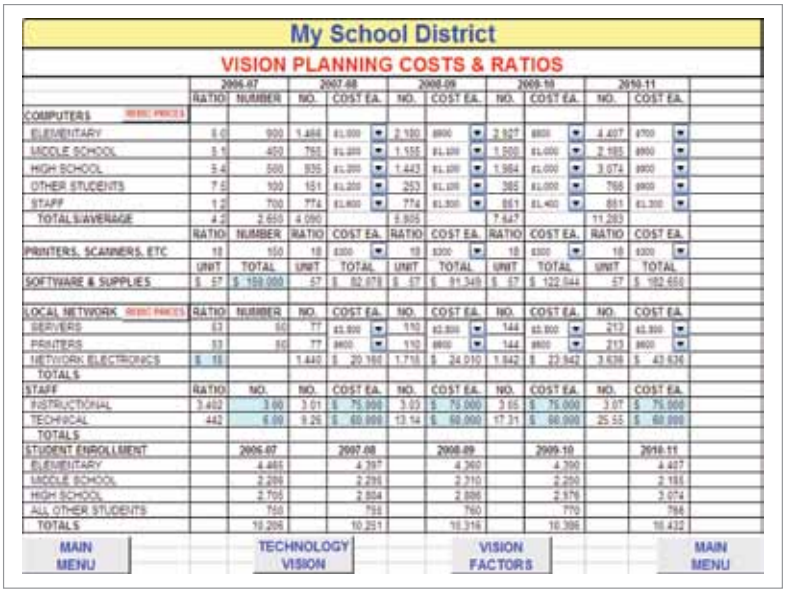
- vision and prioritization of systemic technology goals
- identification of resources needed to implement the vision
- identification of current resource allocation and results
- calculation of acquisition and vision-implementation costs
- identification of funding sources
- communication of the technology plan to stakeholders
- development of a multi-year planning tool

DTPP is a projection tool that provides the district's top-level leadership team with the ability to easily and systematically plan and communicate short- and long-term technology needs, costs, and funding sources

What follows is sample slides from the One-to-One Institute's DTPP work program.

Total cost of ownership or value on investment

Technology planning must be integrated into the annual budgeting process, as it addresses data gathering, assess-

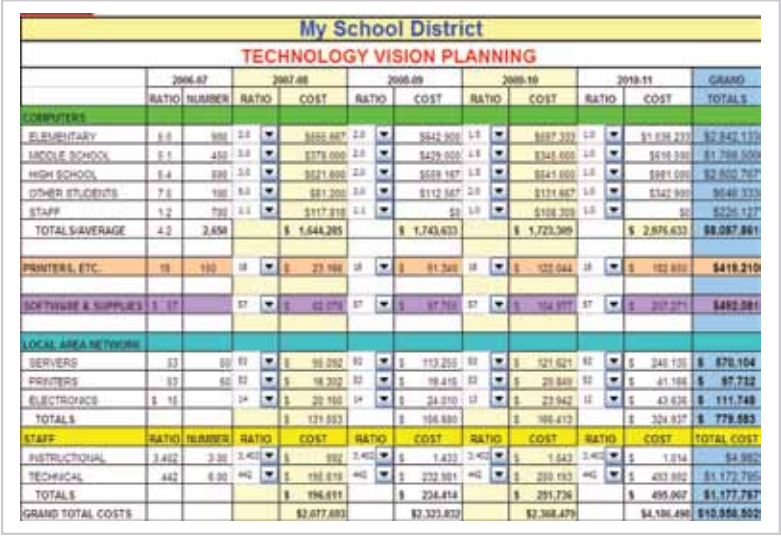


My School District

VISION PLANNING COSTS & RATIOS

	2006-07		2007-08		2008-09		2009-10		2010-11	
	RATIO	NUMBER	NO.	COST EA.	NO.	COST EA.	NO.	COST EA.	NO.	COST EA.
COMPUTERS										
ELEMENTARY	5.0	900	1,466	$1,000	2,100	$800	2,927	$800	4,407	$700
MIDDLE SCHOOL	5.1	450	765	$1,200	1,155	$1,100	1,500	$1,000	2,585	$900
HIGH SCHOOL	5.4	500	935	$1,200	1,443	$1,100	1,964	$1,000	3,074	$900
OTHER STUDENTS	7.6	100	151	$1,200	253	$1,100	385	$1,000	766	$900
STAFF	1.2	700	774	$1,800	774	$1,500	861	$1,400	861	$1,300
TOTAL $/AVERAGE	4.2	2,650	4,090		6,905		7,447		11,283	
	RATIO	NUMBER	RATIO	COST EA.	RATIO	COST EA.	RATIO	COST EA.	RATIO	COST EA.
PRINTERS, SCANNERS, ETC	10	100	10	$300	10	$300	10	$300	10	$300
	UNIT	TOTAL	UNIT	TOTAL	UNIT	TOTAL	UNIT	TOTAL	UNIT	TOTAL
SOFTWARE & SUPPLIES	$ 57	$ 150,000	57	$ 82,078	$ 57	$ 91,349	$ 57	$ 122,044	57	$ 162,650
LOCAL NETWORK	RATIO	NUMBER	NO.	COST EA.	NO.	COST EA.	NO.	COST EA.	NO.	COST EA.
SERVERS	33	50	77	$2,500	110	$2,500	144	$2,500	213	$2,500
PRINTERS	33	50	77	$600	110	$600	144	$600	213	$600
NETWORK ELECTRONICS	$ 10		1,440	$ 20,160	1,715	$ 24,010	1,942	$ 22,942	3,636	$ 43,636
TOTALS										
STAFF	RATIO	NO.	NO.	COST EA.	NO.	COST EA.	NO.	COST EA.	NO.	COST EA.
INSTRUCTIONAL	3.402	3.00	3.01	$ 75,000	3.03	$ 75,000	3.05	$ 75,000	3.07	$ 75,000
TECHNICAL	442	6.00	9.26	$ 60,000	13.14	$ 60,000	17.31	$ 60,000	25.55	$ 60,000
TOTALS										
STUDENT ENROLLMENT		2006-07		2007-08		2008-09		2009-10		2010-11
ELEMENTARY		4,465		4,797		4,360		4,700		4,407
MIDDLE SCHOOL		2,295		2,295		2,310		2,250		2,155
HIGH SCHOOL		2,705		2,804		2,886		2,576		3,074
ALL OTHER STUDENTS		760		758		760		770		766
TOTALS		10,206		10,251		10,316		10,306		10,402

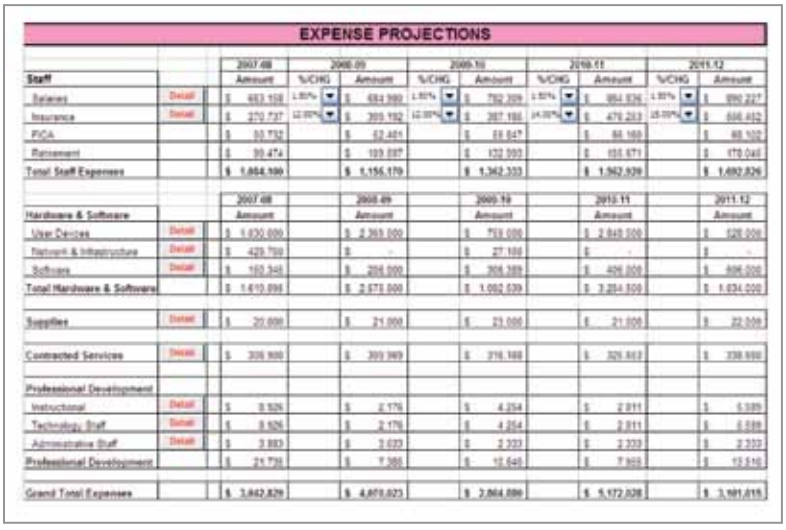
MAIN MENU | TECHNOLOGY VISION | VISION FACTORS | MAIN MENU



My School District

TECHNOLOGY VISION PLANNING

	2006-07		2007-08		2008-09		2009-10		2010-11		GRAND
	RATIO	NUMBER	RATIO	COST	RATIO	COST	RATIO	COST	RATIO	COST	TOTALS
COMPUTERS											
ELEMENTARY	5.0	900	3.0	$488,667	2.0	$842,800	1.5	$897,333	1.0	$1,036,233	$3,842,133
MIDDLE SCHOOL	5.1	450	3.0	$378,000	2.0	$429,000	1.5	$345,000	1.0	$616,500	$1,768,500
HIGH SCHOOL	5.4	500	3.0	$521,600	2.0	$559,167	1.5	$641,000	1.0	$881,000	$2,602,767
OTHER STUDENTS	7.6	100	5.0	$81,200	2.0	$112,567	2.0	$131,667	1.0	$342,900	$668,333
STAFF	1.2	700	1.1	$117,818	1.1	$0	1.0	$108,209	1.0	$0	$226,127
TOTAL $/AVERAGE	4.2	2,650		$ 1,644,285		$ 1,743,633		$ 1,723,309		$ 2,876,633	$8,087,861
PRINTERS, ETC.	10	100	10	$ 23,166	10	$ 91,349	10	$ 122,044	10	$ 162,650	$419,210
SOFTWARE & SUPPLIES	$ 57		57	$ 82,078	57	$ 91,349	57	$ 122,044	57	$ 162,650	$492,081
LOCAL AREA NETWORK											
SERVERS	33	50	33	$ 19,292	33	$ 113,210	33	$ 121,621	33	$ 246,130	$ 670,104
PRINTERS	33	50	33	$ 18,202	33	$ 19,415	33	$ 20,849	33	$ 41,166	$ 97,732
ELECTRONICS	$ 10		14	$ 20,160	14	$ 24,010	13	$ 22,942	13	$ 43,636	$ 111,748
TOTALS				$ 131,553		$ 104,880		$ 166,413		$ 324,937	$ 779,583
STAFF	RATIO	NUMBER	RATIO	COST	RATIO	COST	RATIO	COST	RATIO	COST	TOTAL COST
INSTRUCTIONAL	3.402	3.00	3.402	$ 992	3.402	$ 1,433	3.402	$ 1,643	3.402	$ 1,814	$4,982
TECHICAL	442	6.00	442	$ 195,619	442	$ 232,981	442	$ 289,193	442	$ 493,692	$1,172,795
TOTALS				$ 196,611		$ 224,414		$ 291,736		$ 495,507	$1,177,787
GRAND TOTAL COSTS				$2,077,693		$2,323,832		$2,368,479		$4,196,490	$10,958,502



EXPENSE PROJECTIONS

Staff		2007-08 Amount	%CHG	2008-09 Amount	%CHG	2009-10 Amount	%CHG	2010-11 Amount	%CHG	2011-12 Amount
Salaries	Detail	$ 483,158	1.50%	$ 684,980	1.50%	$ 792,309	1.50%	$ 954,836	1.50%	$ 990,227
Insurance	Detail	$ 270,737	12.00%	$ 309,192	12.00%	$ 267,186	14.00%	$ 476,233	15.00%	$ 646,402
FICA		$ 50,732		$ 62,461		$ 69,847		$ 84,160		$ 88,102
Retirement		$ 99,474		$ 103,837		$ 122,093		$ 153,671		$ 179,045
Total Staff Expenses		$ 1,004,100		$ 1,156,179		$ 1,362,333		$ 1,562,939		$ 1,692,826

Hardware & Software		2007-08 Amount	2008-09 Amount	2009-10 Amount	2010-11 Amount	2011-12 Amount
User Devices	Detail	$ 1,030,000	$ 2,369,000	$ 703,000	$ 2,949,000	$ 528,000
Network & Infrastructure	Detail	$ 429,759	$ -	$ 27,189	$ -	$ -
Software	Detail	$ 193,346	$ 204,000	$ 306,389	$ 406,000	$ 606,000
Total Hardware & Software		$ 1,613,096	$ 2,573,000	$ 1,052,539	$ 3,354,000	$ 1,134,000
Supplies	Detail	$ 20,000	$ 21,000	$ 23,000	$ 21,000	$ 22,000
Contracted Services	Detail	$ 306,900	$ 300,969	$ 316,168	$ 329,813	$ 338,000
Professional Development						
Instructional	Detail	$ 8,526	$ 2,176	$ 4,254	$ 2,911	$ 5,589
Technology Staff	Detail	$ 8,526	$ 2,176	$ 4,254	$ 2,911	$ 5,589
Administrative Staff	Detail	$ 3,883	$ 3,023	$ 2,333	$ 2,333	$ 2,333
Professional Development		$ 21,735	$ 7,365	$ 10,840	$ 7,955	$ 13,510
Grand Total Expenses		$ 3,642,829	$ 4,669,023	$ 2,864,899	$ 5,172,028	$ 3,191,015

ing, and accountability for the district's performance according to established goals. Because are districts purchasing more information technologies and aligning human and technical infrastructures for support, educational leaders must evaluate their return on dollars invested in technology, processes, outcomes, and staff training. In turn, these findings must be communicated to stakeholders to garner support and enhance each person's ability to implement technology tools effectively.

Understanding the finances of a district and the funds likely to be available for funding a technology program is the first step. Before allocating amounts for specific parts of the program, districts must analyze the total cost of technology ownership—for that year and well into the future.

The total cost of o(TCO) is a strategy that districts adapted from business and now use to determine the costs of implementing and maintaining computers and networks. These costs include those for hardware and software technology and for direct labor provided to support a computer network infrastructure, as well as the more elusive, soft costs incurred by computer users in training and dealing with system problems, downtime, and other technology-overhead concerns.

A TCO analysis can become an important part of ongoing technology and budget planning. Determining an overall technology cost can help education leaders conduct the most comprehensive assessment possible to determine how well they are managing their technology infrastructure. This analysis will help school leaders understand how to budget more wisely to manage their networks and technology initiatives for the long term.

In addition, NCLB requires school districts to review and update their technology plans in order to show the impact that technology improvements have on academic achievement. The TCO analysis can help school leaders make the case that the dollars they are spending on educational technology are spent well. This kind of analysis is likely to gain credence from makers

of education policy, whether they are members of local school boards or of legislative bodies.

While gathering and analyzing the computer, network, and other cost elements may seem straightforward to the casual observer, the technology-industry research and advisory firm Gartner, Inc. has identified about 1,900 cost elements throughout an enterprise.

Fortunately, there is some relief for school leaders when it comes to collecting and analyzing all this data. The Consortium for School Networking (CoSN) and Gartner, supported by funding from the U.S. Department of Education, have developed a Web-based K–12-specific TCO tool by means of which the number of data elements has been consolidated to about 150 fields. While data collection still requires a focused effort, most users feel that the learning and discovery are well worth it.

This online TCO tool is a vendor-neutral, free resource available to help schools and districts manage their computer networks cost-effectively. When school leaders input their data, the TCO tool automatically calculates metrics that can then be evaluated compared with the high and low numbers that were calculated for eight case-study districts (www.cosn.org/Initiatives/ClassroomTotalCostofOwnership/CoSNGartnerTCOTool/tabid/5124/Default.aspx).

It can be time-consuming to discover and input all the data necessary to calculate projected costs. Yet costs emerge from input on current and projected inventory and practices, professional-learning needs, characteristics and proposed modifications of the structure, electrical-power consumption, and technology-plan goals.

A basic characteristic of TCO is that implementing technology affects an entire school and district system, not only the hardware and software budget. The TCO will drive the professional-development program, instruction, use of facilities, and energy consumption. A focus on these qualities during the planning and organizing phases will result in well-informed data-driven decisions during the implementation stage.

There is TCO and Project TCO:

1. TCO for K–12 (www.cosn.org/tco) is based on Gartner's distributed computing TCO model and is a snapshot of annualized cost of networked computing. It covers three major categories of cost:
   a. technology: including end \-user computers, LAN network, servers, software, printers, and external services
   b. direct labor: IT department and any others responsible for the care and feeding of the IT infrastructure
   c. indirect labor: end-user time in training and casual learning and dealing with technological problems
2. Project TCO: the cost of implementing and maintaining a technology project; the cost side of a value-of-investment assessment (www.cosn.org/voi). Included are initial costs and ongoing costs. For TCO purposes, initial costs are amortized for the life of the project. Included are:
   a. technology: initial cost, annualized for TCO
   b. implementation, direct labor: initial cost, annualized for TCO
   c. implementation, end user: initial cost, paid end-user time planning, developing, and in training, annualized for TCO
   d. implementation, indirect labor: initial indirect cost, volunteer time by non-IT staff, annualized for TCO; not budgeted, for TCO only
   e. building refurb: initial cost, annualized for the life of the capital improvement (often longer than the project life)
   f. ongoing annual supplies, support, services: direct costs; energy use goes here (use CoSN's Energy Usage Calculator, www.cosn.org/green-computing)
   g. ongoing indirect labor: not budgeted, for TCO only

Factors

The concept of the value of investment (VOI) takes into account both ROI factors (including staff productivity) and qualitative factors in comparing the relative value of proposed technology projects. These factors can include:

- operational efficiency: effect on TCO, including indirect-labor costs
- project risk: probability of the project's meeting educational or financial expectations
- educational fit: the relationship between curriculum and technology

- technology emphasis: alignment with the school's objectives
- equity: helping provide equal access to learning for all
- time on task, absenteeism, standardized testing, graduation and college entry percentages
- user satisfaction and staff retention
- teacher proficiency
- impact: percent of total population affected
- scalability: fit with district long-range plan
- providing 21st-century skills
- solution quality and vendor support

See the VOI case study on online learning from Wisconsin (www.cosn.org/Initiatives/ValueofInvestment/CaseStudies/tabid/6529/Default.aspx).

The value of technology investment

Understanding the full range of costs associated with technology assists school leaders in budgeting for the future. Measuring the potential benefits of proposed projects against these costs provides a comparative financial return on investment. Adding likely student achievement measures and risk-assessment processes provides the most comprehensive measure for evaluating proposed projects.

The Project RED study revealed that the greatest ROI occurs when educational technology is properly implemented. Supplying hardware and software to students, teachers, and administrators does not ensure achievement of goals or school-reform measures. Understanding and implementing the steps for proper implementation are crucial to any project's success.

The ROI focuses on the value compared with the cost of proposed projects. For example, for projects that are intended to reduce school or district costs, ROI is a way to prioritize. Both initial and ongoing costs are measured against the benefits over the useful life of the project. However, ROI is only a partial solution. Since the "business" of schools is education, the bottom line for school districts is students' academic success. There are some measures, such as time –on task, attendance and test scores, graduation rates, behavioral problems, and more, that districts can review for the impact of technology investments.

Summary

This chapter addressed the following essential components of financing an e-learning environment:

- the necessity of leading educational technology in schools
- strategies and considerations for good planning
- internal and external funding possibilities
- considerations when looking at total funding picture
- federal, state, and local source options
- tools to facilitate knowing technology costs, reallocating current resources, and using cost avoidance for determining funding stream

Checklist

The following checklist is an inventory of important actions and activities for financing an e-learning environment:

☑**Responsibility recognition: leading educational technology in schools**

- identification of short- and long-term goals and funding streams
- aligning educational technology with district goals and student outcomes
- tie back to research
- communicating the above to the community powerfully

☑**Good planning strategies**

- costs analyzed and planned for
  - hardware
  - software
  - human capital
  - licensing
  - capital

☑**Identifying internal funding**

  - cost avoidance
  - resource reallocations
  - revenue enhancements
- Considerations of:
  - digital content
  - open-source and Web-based resources
  - free Web tools
- blended learning options
- power savings
  - virtualization
  - cloud computing
  - green resources and activities

☑**Overarching funding sources**

- federal
  - upcoming reauthorization of No Child Left Behind
  - possible Enhancing Education Through Technology funds (in question as of this writing)
  - Title I
  - Race to the Top
  - Individuals with Disabilities Education Act (IDEA)
  - Investing in Innovation (i3)
  - Effective Teaching and Learning for a Complete Education
- state
  - issuance of local bond (i.e., school-district borrowing)
- other
  - technology financing, leasing
  - philanthropic grants
  - parent/caregiver purchases: bring your own devices
  - staff purchases
  - current budget
  - combining funds
  - business partnerships
  - consortia
  - local foundations
- Tools for identifying costs, reallocating funds, and cost avoidance
  - Dynamic Technology Planning Program
  - total cost of ownership
  - value of investment

Chapter 11: Determining and Evaluating Results

Why is it important to evaluate what you are doing?

Schools decide to integrate technology for various reasons. District leaders may want to be able to collect, manage, and use student data more easily. Administrators may want to use technology to improve communication, collaboration, and professional learning, and teachers may be more interested in ways that the technology can make content more engaging and interactive. Whatever the reasons for integrating technology, there are several reasons that it is important to evaluate its effectiveness.

The most common reason to conduct an evaluation is to understand the impact of technology. Often districts hire an outside evaluator to examine the effects of a new program, and schools leaders may use the results to decide on further funding and support of the program.

In other cases evaluations are conducted internally on a much smaller scale. If an administrator expects to improve communication through the use of a new software platform, for example, he or she can determine if the investment is actually improving communication. Similarly, if a school has made an investment in a new classroom technology, it is important for the teacher and administrator to know if the technology is having the desired effect. This level of evaluation often provides valuable feedback that identifies where adjustments must be made. It may then be possible to catch potential problems early and identify where support

and professional development are needed to maximize the benefits of the initiative.

Determining what to evaluate

For an evaluation to be effective, schools must first decide what to evaluate and what purpose the evaluation will serve. Districts tend to have many of the same goals for their technology implementations. The Metiri Group identifies six goals that appear most often in evaluations of educational-technology programs. These goals are:

1. improving academic achievement
2. increasing students' engagement
3. increasing students' ability to compete in a global market
4. increasing curricula's relevance and connection to the real world
5. closing the digital divide
6. building 21st-century skills

These are all laudable goals, but they are too broad to be used as outcomes of success in and of themselves. To be able to measure whether an initiative is successful, it is necessary to transform these goals into measurable outcomes that are specific to the environment and context. Districts should also consider how much to tackle at one time. Prioritizing goals and then picking two or three to focus on may be the most prudent path to success. Collecting data and external evaluations can be expensive, so it is advisable to choose goals carefully, scan the environment for data that may already be available, and then choose to invest in a means of data collection that most closely aligns with district priorities.

When developing measurable outcomes, it may be helpful to start by posing some simple questions about the technology implementation. For example, a district is using new digital content and Web resources in the hope that they will engage students in new and dynamic ways. Possible questions are:

- Are students more engaged when using these digital resources than when using textbooks?
- How often are students using these resources?
- How has the delivery of instruction changed with the use of the digital content?

Each of these questions requires a different method of data collection. Therefore, it is essential to determine the questions carefully.

It is also important that everyone with a vested interest in the initiative be involved in this phase of the evaluation. Take the example above. Even if everyone is agreement about the goal of the initiative, there may be many valid questions that others will want answered that stem from their roles in the initiative.

Once there is agreement about the specific questions to answer, it is time to decide what evidence is needed. Let's return for a moment to the previous question, "Are students more engaged when using the new digital resources than when using textbooks?" To answer this question, you will need a way to measure how engaged students are when using textbooks. Then you will need to measure how engaged students are when using the digital content. Once you have these two measurements, you can compare them to see if students are more engaged when using the digital content.

The most difficult part of this process is coming up with logical indicators of your outcomes. In our case, for example, what will you use as an indicator of engagement with textbooks or with digital content? As you will see in the Freedom to Learn example below, engagement may be measured in a number of ways. You may ask students if they like the digital content more than textbooks, or you may study their time on task. The important thing is that whichever indicators you ultimately choose, you will need a logical argument for why the data are a real indicator of your outcome.

Designing the evaluation

Once you have determined what you want to evaluate and what kind of evidence you may need, you can begin to design your evaluation. If you are interested in a formal, large-scale program evaluation, it is advisable to find an expert who can help you. A local university may be an appropriate and cost-effective resource. There are also a number of consulting firms that are well known for their program-evaluation work.

When designing an evaluation, one of the first things to decide is whether to use a qualitative approach, a quantitative approach, or a combination of both. Simply defined, qualitative data use words while quantitative data use numbers.

If the purpose of the evaluation is to prove to an outside community that an initiative works, for example, a quantita-

tive approach is effective. In this approach, set up an experiment with a control group and a treatment group, collect baseline data, introduce the treatment, collect post-treatment data, and use statistical analysis to find the results.

There are a number of instruments that may be used to collect quantitative data. Among them are:

- pre-tests
- post-tests
- a sequence of tests given over time
- surveys
- interviews
- observations

The key is that all these measures must be quantifiable—that is, you must be able to turn the answers or observations into numbers that can be subjected to statistical analysis. The ultimate goal of quantitative research is to be able to make generalizations based on statistical evidence.

If the purpose of your evaluation is to get a broader picture of what is happening in the classroom, you may decide to use a qualitative approach. There are a number of standard methods used to collect qualitative data. Among them are:

- surveys
- interviews
- observations
- collecting of artifacts
- case studies

In general, these instruments are used to describe things through narrative and to draw conclusions based on patterns that emerge from the data.

Now that we have an idea of the quantitative and qualitative approaches, let's look again at the example of the goal of increase students' engagement. It is difficult to know what is going on in a student's head, so it is hard to determine if a student is "more engaged." In this case we may use several methods to find evidence of engagement. We may survey students or interview them. We may use classroom observations. We may look at server data that show the amount of time a student used a software program or a Web site. Using a selection of measures like these helps build a broader understanding of what is actually happening, and possibly of why it is happening.

Below is a chart that defines some of the advantages and disadvantages of data-collection methods.

Different methods of collecting information

Survey (mail, email, Web based)	• Can survey many people • Not time-consuming • Relatively inexpensive • Everyone gets the same instrument • Objective interpretation	• Difficult to get much detail • Sometimes difficult to get correct addresses • May be problems with question interpretation • Sometimes difficult to get surveys completed and returned (low response rate)
Survey (telephone)	• Can ask for more detail when needed • Everyone gets the same instrument	• Sometimes difficult to reach people • Lack of anonymity
Interview	• Researcher can know how people are interpreting questions • Can ask for more detail when needed • Provides detailed data	• Time-consuming • Subjective interpretation • Can be expensive • Can be difficult to analyze
Focus group	• Researcher can know how people are interpreting questions • Can ask for more detail when needed • Can interview many people at one time, thus more cost-effective • Responses from one person provide stimulus for other people	• Group setting may inhibit some individuals from providing information • Sometimes hard to coordinate many schedules • Responses from one person provide stimulus for other people
Observation	• Objective interpretation • Low burden for people providing data	• Time-consuming • Some items are not observable • Can be expensive • Participants' behavior may be affected by observer's presence
Student records	• Objective interpretation • Low burden for people providing data • Relatively inexpensive	• May not correspond exactly to what researcher wants • May be incomplete or require additional interpretation • May require special permission to use
Collection of materials	• Objective interpretation • Low burden for people providing data • Relatively inexpensive	• May not correspond exactly to what researcher wants • May be incomplete or require additional interpretation

Evaluating the results

We have investigated how to determine what to evaluate and how to design an evaluation. Now we are ready to look at ways to analyze the results of data collection. To follow the guidance in this chapter to develop an evaluation, choose indicators that align with the original program goals, collect the data, and evaluate the results.

The first step is to compile your data into a manageable form. If you have narrative data, list everything and try to consolidate the list into common themes or ideas. If you have numerical data, use the simplest statistics you can to calculate averages, a series of averages, means, etc. It will be helpful to go back to your questions to see which types of answers make sense. The main point is to transform the data into something that is manageable and from which you can derive meaning.

Once you have consolidated your data, the next step is to group the data around your indicators and their associated goals. A "Drawing Conclusions" worksheet is provided in Appendix B to help you organize everything. The worksheet includes four columns: data, indicators, goals, and conclusions. Don't be concerned if data from many sources relate to several goals. Place all the data that you believe will help support a conclusion about the goal in the corresponding data cell even if it has been used in another row.

Now that we have gone through the entire evaluation-development process, let us examine how the Freedom to Learn program used the guidelines in this chapter to evaluate its statewide program.

Evaluation model: External program evaluation

Freedom to Learn, Michigan

Description: Michigan's Speaker of the House, Rick Johnson, and educational leaders initiated the Freedom to Learn (FTL) program in 2001. In 2002, the state legislature seized the opportunity to use state and federal Title IID funding to begin the program, which was rolled out in stages in the hope of extending it to all 130,000 sixth graders in the state.

The first stage of the rollout was the "demonstration phase," which included implementation in six demonstration sites, one showcase site, and eight program-application sites. Each of these 15 districts chose different grade levels, types and vendors of technological devices, and partner organizations; 7,256 students in 93 buildings in grades K–12 used devices, the vast majority of which were laptops.

The FTL program was expanded in 2004 in "high need" districts, one-third of which were not meeting adequate yearly progress (AYP) goals for academic achievement. To qualify, school districts had to meet eligibility criteria approved by the Michigan State Board of Education, including high need (poverty), high priority (not meeting AYP), and technological readiness.

Districts that were awarded FTL grants also had to commit to the program for a minimum of four years, which included participating in the ongoing FTL program evaluation, professional development, and other, related activities. By 2005, the Freedom to Learn program was serving more than 23,000 students from 191 schools representing 100 school districts.

Determining what to evaluate: Freedom to Learn identified the following goals, which formed the basis for the formal evaluation of the program.

1. Enhance students' learning and achievement in core academic subjects with an emphasis on developing the knowledge and skills requisite for the establishment of a 21st-century workforce in Michigan.
2. Provide greater access to equal educational opportunities statewide through ubiquitous access to technology.
3. Foster effective use of wireless technology through systematic professional development for teachers, administrators, and staff.
4. Empower parents and caregivers with the tools to become more involved in their children's education.
5. Support innovative structural changes in participating schools and sharing of best practices through the creation of human networks among program participants.

Designing the evaluation: The Center for Research in Education Policy at the University of Memphis was hired as an independent evaluator. Because many of the goals of the program did not lend themselves to an experimental design, CREP used surveys, interviews, and observations to collect its data. A combination of qualitative and quantitative measures added to the richness of its results.

Classroom observations were used to generate data regarding enhanced learning and the development of 21st-century skills. The researchers used Multi-Class & Targeted School Observation Measures (SOM) and Observation of Computer Usage (OCU) to collect their data during the observation (see Appendices C and D). These instruments examine such things as the use and non-use of 24 instructional strategies, the types of software being used, and the overall meaningfulness of the computer activities.

A variety of surveys were also used to collect data from students, teachers, lead teachers, and parents. These surveys captured their impressions regarding the impact of laptop use on learning, the enjoyment gained from using the laptops, how the laptops were commonly used, and the support for the program in general.

Two other quantitative measures were used to collect data. Students were asked to complete a problem-solving task and a technology task, and state academic achievement data were used for comparison with the achievement levels of students in comparable schools that did not have the technology.

Evaluating the results: The CREP researchers organized their data around the originally stated goals. Below are their findings as they were stated in the Michigan 2005–2006 Evaluation Report. They state the goal and then the related evidence.

- *Enhance students' learning and achievement in core academic subjects with an emphasis on developing the knowledge and skills requisite for the establishment of a 21st-century workforce in Michigan.*

The results show that FTL students had greater advantages than non-FTL students with regard to developing the knowledge and skills needed to achieve success in the 21st-century workforce and equal to or enhanced advantages for increased learning and achievement. FTL students as compared to control students exhibited significantly greater ability to locate and utilize Internet resources, develop computer-based presentations, and solve problems.

- *Provide greater access to equal educational opportunities statewide through ubiquitous access to technology.*

The FTL program served many urban and rural schools throughout Michigan. Low-performing schools in Detroit, Flint, Lansing, Pontiac, and Grand Rapids participated in the program, allowing many of their students to access a computing device and the Internet on a regular basis for the first time.

In rural areas of Michigan, the technology allowed students to connect to resources and learning opportunities and to communicate and collaborate with students and content experts in ways that are unimaginable without the technology. Because small schools and districts in remote areas are located so far from any urban area, not to mention a large public library or diverse professionals or cultures, the Internet provided a window on the world that had never been available to people that live in these areas.

Nearly all students reported that they loved using the laptops and wanted to continue using them in subsequent years. Similarly, the FTL teachers reported that having laptops had increased students' motivation and learning, and that they couldn't image teaching without them.

- *Foster effective use of wireless technology through systematic professional development for teachers, administrators, and staff.*

The Freedom to Learn administration set up several levels of professional learning for teachers. The experiences included the development of "lead teachers" within each FTL school. The program also trained "supercoaches" who worked regionally to support the lead teachers and programs within their geographic area. Teachers and administrators had training on a wide variety of subjects, and a social network provided opportunities for them to share and collaborate.

According to researchers, classroom observations provided evidence of professional development's effectiveness. FTL teachers implemented lessons that were significantly more meaningful and more student centered and more often used laptops as tools for learning than teachers represented by national norms. The results suggest that the PD focus and approach to preparing teachers to integrate the use of laptops effectively was successful. Researchers reported a different result for administrators. Lead teachers from about a third of FTL schools reported fairly low levels of administrator participation in FTL PD; however, many of them modeled the use of technology and were directly involved in the school's laptop program.

- *Empower parents and caregivers with the tools to become more involved in their children's education.*

Parents overwhelmingly supported the FTL program. Researchers received direct information from more than 1,200 parents/caregivers to the effect that they were supportive of their children using laptops at school. Almost all parents agreed that using the laptop had improved their children's research skills and increased their interest and achievement in school. Parents' direct involvement in the program, however, was minimal, and very few participated in FTL-sponsored computer training.

- *Support innovative structural changes in participating schools and sharing of best practices through the creation of human networks among program participants.*

According to the Michigan 2005–2006 Evaluation Report, FTL schools made significant structural changes that they attributed to the FTL program. The researchers noted that in student-centered activities, FTL teachers and students used technology more than the national norms. FTL students also demonstrated significantly greater ability with problem solving, the Internet, and presentation software than matched-control students. Additional evidence is seen in FTL teachers' being significantly more confident about integrating technology than national norm teachers.

The Michigan Freedom to Learn program demonstrates the use of an outside evaluator to study a very large statewide program. So how can a district use the guidelines in this chapter on a much smaller scale to conduct an evaluation of a school or district program? Let's look at the example below, from Auburn City Schools.

Evaluation model: Internal program evaluation

Auburn City Schools, Alabama

Goals: The mission of Auburn's 21st Century Learning Initiative is to "prepare 21st-century students and educators to be contributing members of an ever-increasing technological and global society through an anytime, anywhere learning environment." The district developed three goals that it believes will achieve this mission.

1. Teachers will change and improve the delivery of instruction to realize the benefits of a one-to-one computing environment.
2. To increase students' achievement, engagement, and ability to learn to meet the demands of the world they are entering.
3. To create and support equitable opportunities for student learning through the use of technology as an extension of the classroom.

Let's look at Auburn's first goal and follow it though to its implementation and ultimately to evaluation.

- Teachers will change and improve the delivery of instruction to realize the benefits of a one-to-one computing environment.

Objective: After the goal was developed, the district created a more specific and practical objective that reflected the goal.

- To infuse curriculum, instructional methods, content, projects, and lessons with 21st-century educational technology throughout the daily delivery of classroom instruction.

Activity: Once the district had clarified the objective, it was necessary to define the kinds of activities teachers might use in the classroom to achieve the it. Auburn came

up with the following activity.

- Create and facilitate growth of self-directed and viral learning communities (e.g., wikis) to support independent learning, information gathering and exchange, and communication.

Data collection and analysis: Auburn had to plan with the end in mind, so it decided early on that it could collect the following data to demonstrate that the goal and objective were being met.

- observations: classroom instructional methods
- artifacts: curriculum, lesson plans, and student projects

Auburn decided to use two methods to analyze its data. First it used standardized classroom observations to indicate whether instructional methods in the classrooms were changing. It also compared former and current curricula, lesson plans, and student projects, looking for signs of change in practice and the use of 21st-century skills.

The district used similar procedures to develop an evaluation of all three Auburn goals. The data it collected allowed school leaders as well as teachers to see if they were progressing toward their goals and helped identify where the program was still struggling. These evaluations are seen not as an end point but rather as an ongoing process of assessment, adjustment, and improvement.

Conclusion

Conducting an evaluation for the first time can be intimidating. Most educators are not experts in data-collection methods or in statistical analysis. This may cause some apprehension about taking on such a large task. By taking it one step at a time and following the guidance provided in this chapter, however, anyone can begin evaluating the effectiveness of their technology initiatives. Technology can have a long-lasting impact on students and learning, but it is only when we begin to use data to understand our weaknesses and areas in need of support, or even to prove that our initiative is successful, that we will find ourselves on the path to continued improvement and success.

Summary

This chapter addressed the following essential components of determining and evaluating an e-learning program:

- Choosing program components for evaluation
- How to identify measurable goals
- Incorporating key questions from stakeholders as part of the process
- Key indicators of program success
- How to design the evaluation process
- Strategies for data collection
  - quantitative
  - qualitative
- Plans for data analysis and determining next steps
- Two case studies of effective program evaluations
  - state
  - local

Checklist

The following checklist is an inventory of important actions and activities for determining and evaluating an e-learning program:

☑**Define elements to be evaluated.**

- Identify measurable goals.
- List the key questions from stakeholders.
- Identify "key indicators."
  - How will success be determined?
- Evaluation design
- strategies for collecting quantifiable data
- examples to be evaluated for efficacy
  - pre-tests
  - post-tests
  - a sequence of tests given over time
  - surveys
  - interviews
  - observations

☑**Process for analyzing data**

- Plan to use analysis to drive next steps.

☑**Review of protocol from two case studies in chapter**

Appendices for this chapter

Appendix B: "Drawing Conclusions" Worksheet (Word)
Appendix C: School Observation Measure (SOM) Data Summary (PDF)
Appendix D: Observation of Computer Use (OCU) Targeted Data Summary Form (PDF)

Chapter 12: Conclusion

Systemic thinking

In planning for e-learning, districts should be strategic in their thinking, which means taking into account all of district's needs, resources, goals, and priorities before starting any new initiative. Factors to consider are:

- creating and sustaining technical capacity
- building public, political, and professional support
- developing and supporting policies that promote and sustain reform
- insuring financial resources adequate to building, launching, and sustaining the program
- integrating assessment tools and program evaluation

Define and measure goals

Key to the long-term success of an e-learning initiative is a clear definition of measurable, learner-centered, systemic goals at the outset. As this guide has shown, planners should ground objectives in research and best practice for the purpose of increasing students' success. They should define short- and long-term goals that demonstrate to stakeholders how the initiative will improve the quality and effectiveness of teaching and increase students' achievement.

Educators considering a technology-intensive initiative should do the following:

- Determine the goals and objectives before planning proceeds.
  - Define same for students, teachers, and administrators.
  - Align with district technology, curriculum, and content standards and expectations
- Involve stakeholders.
- Define criteria for evaluating the program's progress that are aligned with objectives.
- Identify an effective leader, with necessary decision-making authority, to lead and manage the project.
- Planners should create strategies that are flexible, frequently evaluated, and modified as needed to engender true transformation based on students' goals. They should use a systematic approach to goal definition that will enable educators to establish realistic action plans in reasonable time frames. All program stakeholders must be involved in the process.

Central to planning for the long term is having a clear focus on the objectives and putting in place the evaluation elements that allow the progress to be monitored continually. This is important to determining whether the intended results are occurring. It is also essential to be aware of the fairness and equity of the goal action plans relative to all affected parties.

Systemic change requires much more than placing laptops in students' hands or bringing mobile carts into classrooms. For technology to play a role in systemic change, school and district leaders must have broad and far-reaching goals: a vision of how technology can transform teaching and learning. In educational-technology programs, this means understanding how the technology can help a school reach all students, teachers, and administrators at all times through a ubiquitous learning environment.

What follows is sample objectives for an e-learning initiative:

Teacher objectives:

- Utilize data-driven decision-making performance solutions.
- Shift from teacher- to learner-centric pedagogy.
- Improve teachers' technological skills.
- Enhance teachers' proficiency and effectiveness.
- Align curriculum, assessments, and instruction with standards.
- Develop a repository of content-neutral supplemental teaching materials, item banks, and content.
- Individualize and accelerate students' learning.
- Monitor progress and differentiate instruction via easy-access classroom dashboards to show real-time performance and diagnostic data.
- Deploy classroom assessments to track students' mastery of skills and standards and adjust instruction to effect progress.
- Involve parents through Web-based communication, collaboration tools, and parental-outreach programs.
- Increase 21st-century (universal) job skills.

Student objectives:

- Extend access 24/7 for school and home use.
  - Become self-directed, learning-centered students.
- Revitalize students' interest.
  - Become creators, producers of content.
  - Develop authentic exhibitions and demonstrations of learning.
  - Increase achievement to highest levels of ability.
- Improve technological skills.
- Improve communication and collaboration with peers.
- Reduce absenteeism and dropout rate.
- Narrow achievement gaps.

Administrative objectives:

- Evaluate results from classrooms and stakeholders on an ongoing basis.
- Provide professional development to meet the needs of faculty, staff, and student body.
- Develop a curriculum that will maximize the learning potential of all students.
- Provide the tools necessary for teachers to teach to their highest capabilities.
- Provide students with the universal skill sets needed for success in the 21st century.
- Create fair and equitable access for all learners.
- Ensure systemic transformation of educational processes.
  - From teacher- to learner-centric environment
  - Emphasis on dynamic rather than static teaching and learning

Key points and checklists

This guidebook provides steps and strategies for planning and establishing a successful e-learning program. The key points made in each chapter are listed below. The chapters also contain checklists of actions and activities for implementing an e-learning environment. In addition, please consult the Buyers' Guide for information on platforms and technologies that can help you build an effective and sustainable program.

Key points

Chapter 1: Understanding Technology for Learning

- The "why" of educational technology
  - universal-skill development
  - an effective workforce
    - student engagement
  - a look at the research
    - key implementation factors
  - The significance of planning
    - elements of effective planning
    - essential readiness questions

Chapter 2: Planning for E-learning

- Components of effective e-learning environment planning
  - leadership
  - vision
  - elements of strategic action planning

Chapter 3: Establishing Policies and Procedures

- Key considerations for policy development
  - How federal and state policies drive those at the local level
- Examples of effective local, state, and federal policies
- Alignment of ISTE's "Top Ten Drivers" for educational-technology-policy development
- Numerous resources for development of acceptable-use policies, online safety for students, education for parents/caregivers
- The fundamentals of K–12 technology security
- How to prevent cyberbullying
- Key considerations for:
  - insurances for theft, damage, vandalism
  - collaborative faculty plan for student consequences
  - media literacy
  - tool access, security protocols
- How to get involved in policy development

Chapter 4: Driving Effective Leadership

- Definition, examples of transformational leadership for technology-enhanced schools
  - collective leadership: using the strengths of all involved
- Research underpinnings
- Stakeholder groups' and individuals' importance
- Focal aspects for leading educational-technology implementations
  - change in culture
  - leaders' practices that ensure a good instructional environment
- The principal's importance to effective leadership
- Components for sustainability leadership

Chapter 5: Creating Professional-Development Systems

- New definition of professional learning for a new century
  - The difference between "training" and "professional development"
- How to meet the needs of all educators in the learning spectrum
- Content areas for professional learning
- Delivery methods: best practices
- Tie-in with students' achievement, curriculum, and standards
- Meaningful versus low-level technology-integration strategies
- Examples of effective processes

Chapter 6: Using Digital Content in Curriculum

- New-century definition for school resources
- Functionalities of digital content for curriculum
- Strategies for differentiating, personalizing teaching and learning
- Examples of digital content and uses
- Common features of digital resources
- The three C's defined
  - consumption
  - collaboration
  - creation

Chapter 7: Managing Classrooms for Change

- Changing role of teacher defined
- How to identify highly effective teachers
- Digital-content decision making
- Curriculum alignment with standards, technology tools
  - Knowing the difference between curriculum and standards
  - Knowing the place for technology integration
- Components for effectively choosing classroom and learning management (CMS and LMS) systems
- Understanding the power of a CMS and an LMS
- Importance of students' skill development for new-century workforce
  - Incorporation of ISTE's National Education Technology Standards
- Ways to engage parents/caregivers in effective, efficient use of educational technology
  - Making home-and-school connections

Chapter 8: Assessing Instruction and Improvement

- Importance of data acquisition, storage, report generation, and analysis to drive teaching and learning decisions
- The tie-in between student assessments (summative and formative): gathering data for analysis to ensure students' progress
- Using data to drive differentiation and personalization for students' learning and monitoring of progress
- Components of differentiated instruction
- Elements of a personalized teaching and learning environment

Chapter 9: Employing a Sustainable Infrastructure

- Learning platforms, functionality, and decision making
  - important factors to consider
- Life-cycle factors for decision making and planning
  - the variety and functions of available software and programs
- Infrastructure components, dynamics, requirements
- Choosing from numerous available devices
- Students' safety and security planning
  - federal law protections
  - anti-theft protocols
- Back-end infrastructure needs
- Software for productivity, analysis, and storage
  - disaster-recovery plans
- Server capacity, choices
  - virtualization
  - cloud computing
- Levels, kinds of personnel technical support
  - rollout plans, policies

Chapter 10: Financing Educational Technology

- for leading educational technology in schools
- Strategies and considerations for good planning
- Internal and external funding possibilities
  - considerations when looking at the total funding picture
- Federal-, state-, and local-source options
- Tools to facilitate knowing technology costs, reallocating current resources, and using cost avoidance for determining funding stream

Chapter 11: Determining and Evaluating Results

- Choosing program components for evaluation
- How to identify measurable goals
- Incorporating key questions from stakeholders as part of the process
- Key indicators of program success
- How to design the evaluation process
- Strategies for data collection
  - quantitative
  - qualitative
- Plans for data analysis and determining next steps
- Two case studies of effective program evaluations
  - state
  - local

Moving forward

Technology is amazing, and schools are using it to produce real results for learning; however, as we said at the beginning, simply putting tools in teachers' and students' hands doesn't guarantee achieving educational goals. This guidebook was created as a handbook for creating effective, robust technology initiatives based on real-life practitioners' successes. It is based on the complex confluence of variables that affect today's schools. We hope it has been useful in understanding some of the key decisions and actionable items to consider as you build or expand your digital learning program and create a culture of change.

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http://www.wlcsd.org/files/421811/Social_Networking_Discussion_Questions_190702_7.pdf

Online Safety Contract
http://www.wlcsd.org/files/421811/Online_Safety_Rules_-_Contract_Universal_Handout_190697_7.pdf

Other helpful links for parents:

Netsmartz Workshop for Parents
http://www.netsmartz.org/Parents

Internet Survival Guide for Parents
http://www.commonsense.com/internet-safety-guide/

iSAFE for Parents
http://www.isafe.org/channels/sub.php?ch=op&sub_id=2

Get Netwise
kids.getnetwise.org

FBI Parents Guide for Internet Safety
http://www.fbi.gov/stats-services/publications/parent-guide/parent-guide

Common Sense Media
http://www.commonsensemedia.org/

Parental Controls (and other information for parents):

AOL http://www.aol.com

Yahoo/AT&T http://www.yahoo.com

Comcast http://www.comcast.com

Cyberbullying

Center for Safe and Responsible Internet Use
www.cyberbully.org

Cyperbullying Research Center
www.cyberbullying.us

StopCyberbullying
www.stopcyberbullying.org

WiredSafety
www.wiredsafety.org

DATA	INDICATOR	GOAL	CONCLUSION

PLEASE DO NOT FOLD OR STAPLE THIS FORM.

DIRECTIONS
MAKE DARK MARKS
EX
ERASE COMPLETELY TO CHANGE

School Observation Measure (SOM) Data Summary

S.M. Ross, L.J. Smith & M.J. Alberg

School Name _____ Observer Name: _____

Date of Observation: _____ SOM # _____ Observer Role/Affiliation: _____

Number of classroom observations comprising this SOM. _____

Directions: Use your class-specific notes to reflect upon the extent to which each of the following is present in the school:

	0 - Not observed	1 - Rarely	2 - Occasionally	3 - Frequently	4 - Extensively
Instructional Orientation					
Direct instruction (lecture)	0	1	2	3	4
Team teaching	0	1	2	3	4
Cooperative/collaborative learning	0	1	2	3	4
Individual tutoring (teacher, peer, aide, adult volunteer)	0	1	2	3	4
Classroom Organization					
Ability groups	0	1	2	3	4
Multi-age grouping	0	1	2	3	4
Work centers (for individuals or groups)	0	1	2	3	4
Instructional Strategies					
Higher level instructional feedback (written or verbal) to enhance student learning	0	1	2	3	4
Integration of subject areas (interdisciplinary/thematic units)	0	1	2	3	4
Project-based learning	0	1	2	3	4
Use of higher-level questioning strategies	0	1	2	3	4
Teacher acting as a coach/facilitator	0	1	2	3	4
Parent/community involvement in learning activities	0	1	2	3	4
Student Activities					
Independent seatwork (self-paced worksheets, individual assignments)	0	1	2	3	4
Experiential, hands-on learning	0	1	2	3	4
Systematic individual instruction (differential assignments geared to individual needs)	0	1	2	3	4
Sustained writing/composition (self-selected or teacher-generated topics)	0	1	2	3	4
Sustained reading	0	1	2	3	4
Independent inquiry/research on the part of students	0	1	2	3	4
Student discussion	0	1	2	3	4
Technology Use					
Computer for instructional delivery (e.g. CAI, drill & practice)	0	1	2	3	4
Technology as a learning tool or resource (e.g. Internet research, spreadsheet or database creation, multi-media, CD Rom, Laser disk)	0	1	2	3	4
Assessment					
Performance assessment strategies	0	1	2	3	4
Student self-assessment (portfolios, individual record books)	0	1	2	3	4
Summary Items					
High academically focused class time	0	1	2	3	4
High level of student attention/interest/engagement	0	1	2	3	4

Rubric for SOM Scoring

(0) Not Observed: Strategy was never observed.

(1) Rarely: Observed in only one or two classes. Receives isolated use and/or little time in classes. Clearly not a prevalent/emphasized component of teaching and learning across classes.

(2) Occasionally: Observed in some classes. Receives minimal or modest time or emphasis in classes. Not a prevalent/emphasized component of teaching and learning across classes.

(3) Frequently: Observed in many but not all classes. Receives substantive time or emphasis in classes. A prevalent component of teaching and learning across classes.

(4) Extensively: Observed in most or all classes. Receives substantive time and/or emphasis in classes. A highly prevalent component of teaching and learning across classes.

SCANTRON FORM NO. F-17021-UM WF3 3102-532-5 4 3 2 1

Observation of Computer Use (OCU©) Targeted Data Summary Form

DIRECTIONS
Use a No. 2 pencil.
MAKE DARK MARKS
EX
ERASE COMPLETELY TO CHANGE

School _____ Observer Name _____ Observer Affiliation _____

Observation Date _____ OCU # _____ of _____ Number of 15-minute segments in this observation _____

Directions: Use information from your OCU Data collection Forms to complete the following sections. Only mark one response per item, unless noted otherwise.

COMPUTER CONFIGURATION

1. This classroom had the following number of computers/ laptops available for student use:
   - ○ None
   - ○ One
   - ○ 2 - 4
   - ○ 5 - 10
   - ○ 11 or more

2. Classroom computers were most frequently:
   - ○ Up-to-date
   - ○ Aging but adequate
   - ○ Outdated/limited capacity
   - ○ No computers were observed

3. Classroom computers were most frequently:
   - ○ Connected to the Internet
   - ○ Not connected to the Internet
   - ○ No computers were observed

4a. Total number of classrooms visited:

○○ ○○ ○○ ○○ ○○ ○○ ○○ ○○ ○○ ○○

4b. Total number of classrooms without students using computers:

○○ ○○ ○○ ○○ ○○ ○○ ○○ ○○ ○○ ○○

COMPUTER USE

5. Classroom computers or digital tools were most frequently used by:
   - ○ Few (less than 10%) students
   - ○ Some (about 10-50%) students
   - ○ Most (about 51-90%) students
   - ○ Nearly all (91-100%) students
   - ○ Students did not use computers

6. Students most frequently worked with computers or digital tools:
   - ○ Alone
   - ○ In pairs
   - ○ In small groups
   - ○ Students did not use computers

7. Student computer literacy skills were most frequently:
   - ○ Poor
   - ○ Moderate
   - ○ Very good
   - ○ Not observed

8. Student keyboarding skills were most frequently:
   - ○ Poor
   - ○ Moderate
   - ○ Very good
   - ○ Not observed

Targeted Frequency Rating

(0) Not Observed	-- Strategy was never observed
(1) Rarely	-- Receives isolated use and/or little time during the class -- Clearly not a prevalent and/or emphasized component of teaching and learning during the class
(2) Occasionally	-- Receives minimal or modest time or emphasis during the class -- Not a prevalent and/or emphasized component of teaching and learning during the class
(3) Frequently	-- Receives substantive time or emphasis during the class -- A prevalent component of teaching and learning during the class
(4) Extensively	-- Receives substantive time and/or emphasis during the class -- A highly prevalent component of teaching and learning during the class

D. L. Lowther & S. M. Ross
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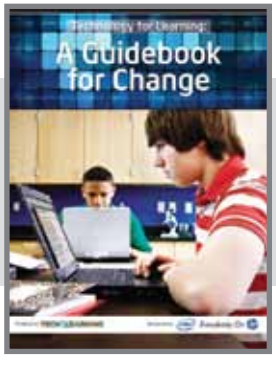

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