Planning for Progress in K-12 Education

Inspired Outcomes through Practical Technology Application
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The demands for an improved and more
digital education system have never been
greater. Technology plays a big role in this
transformation, but making technology an
integral part of education does not happen
by coincidence. Each step of the process
requires strategic decisions that impact the
future of every child in the school system.

Our goal in creating this handbook is for
it to serve as a guide for the beginnings of
a digital education transformation. In these
pages, you will find strategies and tactics
that have worked for schools and school
systems from the state level down to the individual school. We’ve provided steps, ex-
amples and lessons learned, since there are few better ways to learn something than by
seeing how someone else has done it right.

Chapter One of this handbook focuses on integrating technology into the classroom,
so that the focus is never on the computer or whiteboard or smartphone itself, but on
the device as a tool for learning.

Chapter Two identifies the most common elements of the school “technology eco-
system.” This chapter illustrates not only how these elements are used individually, but
also how they synergize to permit different activities to take place in the classroom
simultaneously.

Chapter Three discusses the ways in which technology changes the priorities for
professional education, again not to focus on the technology itself, but to make it part
of the background for learning.

Chapter Four covers the infrastructure that makes the devices used in the classroom
and office work — including electric power, data facilities and networking. This chapter
also covers technology policy and support.

Chapter Five discusses the funding needed for technology. It covers contracts that
help schools make their money go further. It also discusses federal education budgets,
which play an important role in school funding. It describes how schools can form part-
nerships with businesses and a variety of other organizations, from private philanthro-
pies to universities. The practice of shared services, though only emerging in education,
is also included.

Read this handbook in the spirit of discovery — take what makes sense for your situ-
ation and use it as a starting point for your own journey. Use it to educate yourself and
your staff, as a way to introduce ideas to those you lead, as a source for discussion, as
a research document, as an element in justifying technology initiatives — use it in any
way that helps you move your schools into today’s high-tech world.
InTEgraTIng TEChnology InTo EduCaTIon

No modern workplace could function without technology and creative, problem-solving employees who know how to use it to benefit the business. Yet far too many students exit the American educational system without either the technological or cognitive skills to succeed in that workplace. These two opposing conditions combine to create a primary driver for integrating technology into the education system.

Still, despite technology’s importance, it is commonly used as a tool, a means to an end, not the end itself. Technology answers the question, “How do we do it?” Technology can’t address the questions of what we should do or why we should do it.

How can education leaders make technology integration happen? The answer is that they must use technology in teaching math, science, social studies, English and other subjects in ways that excite, engage and motivate their students — without making the technology itself the object of the lesson. It’s a simple answer, but it is in no way easy to execute.

PROSPERITY ELEMENTARY SCHOOL:
Transforming conventional environments into technology-rich classrooms

Sixth-grade teachers at Prosperity Elementary School in Kansas have transformed their conventional learning environments into technology-rich classrooms.

One of the real-world projects students have worked on was related to a busy city intersection at 43rd Street and Plum. Students became concerned after an accident involving one of their classmates at the intersection. The city manager and city engineer came to the school to talk to the students about how the city determines if an intersection needs a stoplight.

Students used the city traffic counters to count cars that passed through the intersection during peak and non-peak hours of the day. Students took this data and made graphs and charts to determine if a stoplight was needed at the intersection. They analyzed the data, surveyed parents at the technology fair and made suggestions to the City Council on keeping the intersection safe. The project incorporated community and school safety, civic mindedness, science and math.

Funds for the project were provided by a grant from the Enhancing Education Through Technology (ESEA Title IIDD) or EETT program in the 2009-2010 school year.

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EVALUATE CURRENT SITUATION
Evaluate the technology that already exists in the school or district and determine who understands that technology. Knowing how to use a device should not be confused with understanding its use in teaching.

ASSESS RESOURCES
Assess all available expertise and financial and human resources. If the funds do not exist for a district-wide or school-wide implementation, this assessment will help in determining where a pilot or small implementation should occur.

CONSIDER THE TECHNOLOGY
The Partnership for 21st Century Skills recommends a baseline strategy that consists of equipping teachers with laptops that have high-bandwidth Internet connectivity, standard productivity tools, and academic and administrative software. It also recommends an interactive whiteboard. The school library needs a media center that can support simultaneous access to electronic resources and a suite of tools for media production. After this is done, laptops or other devices can be deployed to students.

TECHNIQUES FOR INTEGRATION
Problem-based learning: Teachers present students with real-life, relevant problems and encourage them to use Internet resources, laptops and other technology tools to collaborate; analyze and synthesize what they learn; and record, document and present what they find using multi-media tools.²

Collaborative or cooperative learning: According to the Partnership for 21st Century Skills, collaborative groups “have the advantage of promoting teamwork, leadership and other life/career skills, while enhancing academic performance.”³ Teachers can help facilitate the formation of groups, ensuring that each one includes students with diverse skills and abilities. Teachers can also intercede to make sure that no single individual or sub-group dominates and that everyone participates.
It takes many technological elements to create an ideal educational ecosystem. This chapter illustrates not only how these elements are used individually, but also how they synergize to permit different activities to take place simultaneously.

**Ecosystem Elements**

The technological elements of the ideal educational ecosystem include many varieties of hardware and the software that powers it all. Display tools include whiteboards and high-fidelity videoconferencing. Computers, the central technology in this ecosystem, can range from desktops to netbooks. Mobile devices can include tablets, smartphones and auxiliary devices such as e-readers and interactive student response systems. Modern printers round out the essential elements.

**WHITEBOARDS, HIGH-DEFINITION VIDEOCONFERENCING AND DIGITAL SIGNAGE**

Interactive whiteboards, also known as e-boards, are large interactive display devices. An e-board connects to a teacher’s computer and a projector. The projector takes whatever is on the screen of the teacher’s computer and displays it on the e-board.

Students and teachers interact with the display using a special pen, a stylus or even by the touch of a finger. E-boards can be mounted on walls or on rolling stands. Some of them integrate with portable response systems, such as clickers, so that teachers can conduct quizzes, tests and polls and display the real-time results. If a teacher enables them, students’ computers can also network with an e-board, capturing the e-board display screen for future study.
E-boards can bring the world into the classroom, but high-definition videoconferencing does so with dazzling vividness. Videoconferencing lets students virtually travel anywhere there is a high-bandwidth connection and a networked camera. Classrooms in different timezones can adopt each other, share stories, learn together, collaborate … the list is endless. Today’s digital video equipment requires no special rooms and expensive extras. All it needs is an Internet connection.

According to an article on Converge, “through videoconferencing, 69 percent of school districts take students on virtual field trips — a 14 percent increase since 2009.” Jhone Ebert, chief technology officer for Clark County School District in Nevada, says that students have talked with Nevada Sen. Harry Reid over the years. “He will have videoconferencing sessions with our students,” she says. “To think that our students can directly access and have a conversation with him is just amazing.”

Every education professional in a school or district can use these display tools for professional development. Although online courses require only computers, live presentations can be displayed with e-boards or high-definition videoconferencing. Trained expert teachers, technologists and others can teach groups of colleagues using this equipment. Education executives and staff can attend Webcasts together without travel costs by using one of these digital display options.

At the building level, signage is the main element of the ecosystem. It conveys immediate information, and it is going digital. Outdoors, night or day, large-scale, bright, energy-efficient LED-backlit digital signs identify buildings and school executives. The signs can proclaim district and school rankings, announce meetings or athletic contests, and direct crowds to parking and events. Within buildings, in hallways and cafeterias, smaller digital signs — including interactive monitors in kiosks — function as maps and modern-day town criers.

DESKTOPS, LAPTOPS AND NETBOOKS

In the ideal educational ecosystem, all computers should have enhanced multimedia capabilities and Internet connections. The type of computer selected depends on many factors, including cost, form factor and need for portability.

Until the last three to five years, “computer” generally meant “desktop.” For certain environments, such as administrative offices, this is still true. Desktops possess great processing power and speed. They are very familiar in schools — seen on teachers’ desks, in labs, media centers and on rolling carts. Since desktops are usually linked by cable to the Internet (through the district network), wireless connectivity is not necessary. It can, however, be added through plug-ins.
For classrooms, desktops have a few drawbacks, especially in the context of one-to-one initiatives. One drawback is size. Desktops need a lot of space for the tower, monitor, keyboard and mouse. In today’s fiscal environment, with classrooms and even schools merging to reduce facility costs, space is at a premium. Another option is all-in-one computers such as the Samsung Series 7 All-In-One PC, which consolidates the monitor and CPU so it takes up less space. It also offers a dynamic touch screen interface for learning and can support multiple students using it at one time.

The ideal scenario for one-to-one programs is for students to have access to computers 24/7. With desktops, this is clearly impossible. Desktops stay where they are installed. Additionally, any desktop usually costs hundreds of dollars more than any portable computer. For dollar-strapped districts, that price difference may mean a 10:1, 8:1, or perhaps 5:1 student-computer ratio — far from the ideal 1:1.

Consequently, providing a single physical desktop computer for each student is usually not affordable and not necessarily ideal. If desktops are required, however, or if 24/7 access is not considered essential, there are ways to obtain these computers at a reduced cost such as through desktop virtualization. Although virtualization can make desktops available at a lower cost, it still does not make them portable. For that, a portable computer such as a laptop or netbook is needed.

Today’s laptops can do nearly everything a desktop computer can do, in a smaller form factor. Peripherals — keyboard, monitor and mouse — are built in. Rolling cart systems can haul enough laptops to outfit an entire classroom. When one classroom’s session is up, the laptops are collected, returned to the cart and rolled to the next class. The carts also serve as charging stations, and they provide Internet connections.

Some laptops are developed specifically for the education market, like the Samsung Series 2. They are built with low cost in mind. “Ruggedized” laptops can withstand normal student boisterousness. Ideally, laptops should have long battery life, built-in wireless connectivity, and all the multi-media capabilities of a desktop.

Netbooks and subnotebooks have less processing capacity and speed than laptops. They are also smaller, lighter and less expensive. As long as tasks do not require extensive multi-media capabilities or sheer processing power, these devices will be sufficient. Also emerging is the Chromebook, which is a cloud-enabled, affordable laptop-like solution that is easy to manage and maintain.

On the administrative side, school leaders, teachers and staff could not function without computers, whatever their form factor. Managing students, human resources, class schedules, food services, transportation, procurement, security, school events, discipline, and training, just to cite a few of their responsibilities, would be impossible without
computers. Where administrative and classroom computing needs can be satisfied with the same machine, many synergies emerge, including lower equipment costs, easier maintenance and updating, and faster troubleshooting.

**MOBILE DEVICES**

These portable, lightweight, wireless tools include tablets, smartphones and other platforms such as e-readers. Here, we will only examine the first two.

Tablets have become wildly popular since the debut of the iPad. Despite their ubiquity, schools are not limited to this particular tablet and its iOS. Google’s increasingly popular Android operating system now powers many tablets, such as the Samsung Galaxy Tab.

Tablets are small, thin, very lightweight and fairly low-cost devices intended as portable multi-media interfaces. They are ideal for Web browsing, reading e-books (in some formats), online chatting, posting blogs, listening to music and podcasts, and watching video podcasts (vodcasts). Despite their size and apparent limitations, they can be very valuable for education.

Smartphones are computers that make phone calls and run an enormous variety of short, quick “apps.” They can be used for the same array of educational multi-media activities as tablets, just in a smaller form factor. According to the Converge Special Report on Classroom Technologies, some schools are even looking to smartphones as a super low-cost 1:1 solution.⁷

Mobile devices make administrators’ jobs much easier, too. According to the article in *Education Week*, “School Leaders Rely on Smartphones,” Mark J. Stock, then-superintendent of a district in Syracuse, IN, was able to keep parents informed about a school bus accident by using his smartphone to post details to the district’s blog. Michael Smith, superintendent of Oakland Community Unit School District No. 5 in Illinois, says he answers e-mail from parents and students almost around the clock via his smartphone.⁸

**DESKTOP VIRTUALIZATION**

Desktop virtualization converts physical desktops to virtual ones, with applications residing in the data center. Students, teachers and staff can access their school data and applications at any time, from any place, using a wide variety of devices and multiple operating systems. Because their work and the programs they use reside in a secure data center, users do not have to utilize a specific device to access learning content. Samsung’s CloudStation transforms old monitors into powerful virtualized computing stations, with PCoIP displays replacing traditional desktops.

These types of virtual solutions have many advantages for educational IT departments, including reducing the management requirements for IT staff, who otherwise must maintain a traditional computer lab environment. These solutions also better serve the needs of an increasing number of mobile-oriented students and teachers.

**PRINTERS**

Printers now do much more than produce neatly typed documents. Modern printers are really special-purpose computers. They can automatically scan and grade tests, record the scores and integrate the information with other student data.
School districts are increasingly taking advantage of managed print services and document management strategies to reduce the number of printers and unnecessary printing, and also capture hard copy documents and store them as digital assets as they ready the district for improved workflow processes. An optimized print environment allows users to easily share documents, retain and organize digital student records, and increase efficiency by getting rid of manual processes.

Modern printers allow teachers and administrators to effectively and securely track student progress with far less effort than if it all had to be done manually. Printers can now produce integrated reports, secure sensitive data, check the data and its storage methods for compliance with federal privacy regulations, scan documents and physical objects to help teachers develop digital lessons, retrieve and assemble mandated special education annual reports on students, and print out student data and reports for formal presentations.

**SYNERGY**

In the ideal educational ecosystem, multiple learning activities can occur at the same time. E-boards and videoconferences can involve an entire class or just a few students collaborating on a project.

While those students collaborate around an e-board, the teacher can work with another group of students on their computers, help them review difficult lessons, or work with individual students to overcome stumbling blocks and master the material.

Elsewhere in the same classroom, a third group of students can use their computers to create podcasts or vodcasts for a presentation.

Perhaps the rest of the students work independently at their computers, conducting online research, writing blogs, taking an online class or chatting with friends in remote “sister” classrooms in another state or country.

No two students ever have to perform the same activity at the same time or in the same way. Technology, properly integrated into the curriculum, allows students to learn at their own pace and, within the bounds of academic requirements, study what most interests them.

**Buying Educational Solutions, Not Products**

As administrators, teachers and others weigh technology decisions, one decision that must be made early is whether a district will follow a “best-of-breed” approach or choose an integrated, unified solution suite.

The best-of-breed path means selecting each technology element in the ecosystem based on its rankings within that category, i.e., the best printer, the best laptop, the best e-board. Because a variety of devices must be carefully integrated, this approach becomes one of customizing each and every type of device acquired so that it fits within the greater ecosystem.

Such a large-scale integration effort can absorb the full-time efforts of a small army of technology specialists for days, weeks or months. An enterprise with a large technology support department is fully capable of such an effort. Most school districts are not.

In creating the ideal educational ecosystem in any single school district, selecting a pre-integrated solution suite, with full support from the vendor, could be the more effective and successful approach. If the vendor comes in, installs the equipment and connections, provides training and is on call for problems, an ideal educational ecosystem can be up, running and educating students before the first few best-of-breed devices can even speak to each other.
According to Project RED, a national research and advocacy plan for technology in education, schools that do a good job of integrating technology with core educational requirements outperform other schools on a variety of measurements. They report fewer disciplinary problems, higher test scores, fewer drop-outs and higher graduation rates.9

What these outstanding schools have in common is, among other things, excellent professional development — and not just for teachers. Ideally, professional development starts with state leaders and keeps going strong all the way through the district, school and individual educator levels.

It is necessary to understand the relevant technologies in use today, such as the Internet, social media and mobile devices, and how and why they are important. State leaders can obtain much of this understanding informally by attending current events, using the technologies themselves, and learning on the job from experts on their staffs. They can also take advantage of the same formal learning opportunities they fund for professional educators.

District superintendents do not need a chips-and-wires level knowledge of education, either. Like state leaders, whom they advise, they need to understand current technologies and how to use them in an educational setting. Even when a district has a chief technology officer (CTO), superintendents cannot delegate everything to that executive. The CTO may indeed know how to troubleshoot computers and keep a network going, but he or she may not know how to incorporate technology into pedagogy.

To accomplish these crucial responsibilities, educational technology experts and superintendents who understand their roles in district technology leadership have suggestions:

• Check with national professional organizations to see what training they make available and how it fits into your schedule.
• Reach out to technology organizations to see what they offer in the way of educational technology training.
• Find a peer who’s already tech-savvy, build a relationship and share knowledge.
• Select a particular project or task to do, and make a point of using new-to-you technology to execute it.
• Find a technology expert in your district, and ask him or her to be your mentor.
• With all the knowledge you gain, use it to inform your vision for using technology for education in your district.
• Communicate that vision clearly and systematically to all the stakeholders in your district.10
In nations where students outperform American pupils on international assessments, teachers spend about 60 percent of their time in the classroom. They spend the other 40 percent on long-term, continuing, intensive professional development and collaboration.

Principals can follow many of the steps superintendents take to educate themselves about technology. They can sit in on classes to see how teachers integrate specific devices into the curriculum. There is even a Connected Principals blog (www.connectedprincipals.com/) set up by 24 educational administrators from around the world specifically to help principals everywhere learn from each other and share best practices in education, including the use of technology. When a school principal is comfortable with current educational technologies, it’s easier to implement the superintendent’s vision for the district as well as to implement the principal’s vision for his or her own school.

A principal’s effect on students is indirect, but the effect of teachers is direct and immediate. Teachers interact with students every day. They are the most visible and powerful influence in what and how students learn. It should come as no surprise that a teacher’s own education has a powerful impact on what students learn in the classroom. Except for intervention classes, where daily technology use is the top predictor of student learning, what teachers themselves learn through professional development is the most powerful predictor of student performance.

Unfortunately, professional development opportunities for most teachers in the United States tend to be short term (brief conferences and workshops) and limited (no more than 16 hours per year). However, research shows that the more sustained and intensive professional development is for teachers, the better the student results seem to be.

In nations where students outperform American pupils on international assessments, teachers spend about 60 percent of their time in the classroom. They spend the other 40 percent on long-term, continuing, intensive professional development and collaboration.

American teachers, by contrast, spend 80 percent of their time in the classroom. Furthermore, American teachers bear much of the costs of their own professional development, whereas elsewhere, those costs are covered for them.

Good professional development has specific characteristics, including:

- comprehension of the importance of 21st-century skills;
- integration of those skills into daily instruction;
- collaboration among all participants;
- construction of personalized learning communities;
- utilization of local in-school and in-district expertise for coaching, mentoring and team teaching; and
- use of 21st-century tools.

There is no one right road to successful professional development for educators. As long as a program features most or all of the characteristics listed above, a variety of approaches, tailored for individual districts or schools, can be used. The next page of this handbook features a roadmap that can be followed exactly or used as a resource for developing your own program.
INDUCTION AND MENTORING
School leaders should ensure that induction and mentoring is in place for beginning teachers.

PROFESSIONAL LEARNING COMMUNITIES
Professional learning communities (PLCs) should be created at individual schools or in districts, involving teams of teachers, parents and students who focus on specific concerns such as teaching students with disabilities. These individual PLCs can be linked together via the Internet into a network that may span an entire state or region, providing a widespread, home-grown web of voluntary expertise and assistance.

INSTRUCTIONAL SUPPORT
Instructional support can be obtained when regions and districts partner with professional organizations, community colleges, universities and “intermediary organizations” such as local learning centers and school support facilities.15

All steps should focus, to a greater or lesser degree, on ways to creatively address federal and state mandates and audit/accountability requirements in ways that make sense for the local district and school.
Computers, websites, interactive displays, mobile devices — they are the technologies administrators, teachers, staff and students use every day. None of them could function without a vast complex of mostly invisible infrastructure. Electric power, data centers and Internet connectivity make up the bulk of the tangible infrastructure. Without two intangible, crucial components of infrastructure, however, none of the technology can effect the changes people so strongly desire. Those two intangibles are policy and technical support.

Technology Policy

History shows that less than 20 percent of new IT projects are successful, with the other 80 percent suffering some combination of failing outright, massively exceeding budget or getting canceled. And that is in business, which presumably has the funds and the expertise to do whatever it wants.

No statistics on failed technology implementations in K-12 appear to currently exist, but where individual failures have been reported, they result from the same causes as in business: a tendency to let money and gadgetry replace hard thinking and evaluation of the goals of a project, a desire to hurry up and get something done fast, and a reluctance to identify and involve all the stakeholders. In other words, technology failures are strongly linked with the absence of policy.

According to the article “1 to 1 Learning: Building and sustaining a computing program does not happen overnight,” the goals of 1:1 programs need to be undertaken at the school, district and state levels so that questions of ‘why 1:1?’ are answered. “A program needs a mission statement that really answers those questions and provides a road map for how the program will move forward. The mission for some is to improve students’ technology skills; for others, it is to create more opportunities for self-directed learning.”

Although the author of this passage is addressing 1:1 computer programs, her remarks apply equally to other K-12 technology implementations. Without identifying the reasons a project is undertaken and explicitly stating them, the project is unlikely to succeed. When reasons are not publicly identified, everyone involved has his or her individual reasons, but no one has the same goal in mind.

It is up to state, district and school leaders to involve teachers, parents, the community, local businesses, school business partners and even students to hear what everyone wants. It is also up to those leaders to distill the likely long list of wants into a coherent,
sensible policy that matches local needs with federal and state mandates and which can be executed with the available time, human resources and funds.

Policy must include plans for professional development, from the state leadership level on down. As mentioned in previous chapters, administrators and principals must understand and use technology, because they are the models for the entire school system.

When writing technology policy, school leaders must be careful not to focus on specific devices. Otherwise, policies will rapidly become obsolete because of the rapid pace of change. “It’s more efficient to write about proper Internet usage than to try to address how each mobile device with Internet capabilities can be used.”17

“Unfortunately, policy is often written to deal with challenges,’ [says Ann Flynn, the director of educational technology for the Alexandria, VA-based National School Boards Association], which can cause schools’ policies on acceptable Internet use to become laundry lists of restrictions. But by focusing on how students can behave responsibly when they are using technology — on and off the Web — schools can put ed-tech policy in a more positive light,” she says.18

Once the reasons for a technology project are clearly identified and articulated, it is time to write a mission statement. Next, establish a vision committee to identify what else is needed for success. Because this is a process, not an event, stakeholders should again be involved. A formal communications strategy can help ensure that no stakeholders are overlooked. The vision committee, committed stakeholders and leaders of the project should next uncover best practices throughout the state and district through visits and conferences.19

Technical Support

To keep all the devices in a 21st-century educational ecosystem up and running, technical support is essential. When support is not built into a project, and sufficient resources are not allocated, devices can fail to the extent that they become unusable and unreliable. Teachers will not base curriculum upon unreliable tools. Student access to technology is severely limited if it is constantly failing, and teachers will begin relying on other instructional methods.

For pilot projects, The Greaves Group, The Hayes Connection and the One-to-One Institute call for on-site technical support, support and other services from product vendors, laptop charging carts for every classroom where these computers are in trial, an 11th laptop for every 10 used in the pilot, a primary and back-up battery pack for each laptop, and accidental damage and theft insurance for all computing devices.20 When a project moves from the pilot stage to roll-out, charging carts, extra computers and back-up power supplies, and insurance will all still be needed and should be included in the budget.

It is also important to remember that information technology changes rapidly. One computer generation lasts about four to six months before the next new and improved models come out. Schools obviously cannot replace computers this often, but a refresh cycle of two to three years
is reasonable and must be built into the technology policy and the budget. If computers are not maintained and replaced in a timely manner, they fail more frequently, which in turn places increasing demands on technical support. Desktop virtualization, mentioned previously in Chapter Two, is a solution to this as only the central computer requires refreshing, but the hardware tied to it does not.

E-boards, videoconferencing equipment and printers must also be replaced at regular intervals. Scan industry literature to determine their standard lifetimes. District and school technical support should be able to maintain, update, troubleshoot and fix these devices. However, contracts may specify that only the vendor will provide these services.

At the district level, The Greaves Group, The Hayes Connection and the One-to-One Institute call for “enough technology personnel to support the 1:1 program, an established relationship with the device vendor and teacher access to the help desk and other support, a quick response plan for repairs and other technical questions that can be easily communicated to teachers, and, as with pilots, the necessary accidental damage and theft insurance.”21 While this citation specifically references 1:1 programs, the advice is just as relevant for other types of technology.

In some schools, students, instructional technologists and technology-savvy teachers have created their own informal technical support groups. Such groups can be quite successful, although adult authorities must ensure that warranties are not violated by enthusiastic students eager to crack open a computer to diagnose a hardware failure.

Classroom and School Office Infrastructure

In the National Education Technology Plan 2010, the United States Department of Education Office of Educational Technology defines “an infrastructure for learning” as an integration of “computer hardware; data and networks; information resources; interoperable software; middleware services and tools; and devices.”22 That is a long list and could easily be — and has been — the subject of entire volumes. In this section, we will look at electric power, district data centers and the networks required to support classroom use of technology.

ELECTRIC POWER

Often overlooked in planning, electric power is absolutely essential to today’s educational ecosystems. Technology will not operate without it. Overlooking it may mean that when you plug in a raft of brand-new computers, they will not switch on, or the lights may go out when they do.

Older buildings may not have sufficient electrical power to operate all of the computers, display devices and printers in a school. Recharging batteries for dozens or hundreds
of computers overnight uses a significant amount of power and should not be overlooked, either.

There is no right number of kilowatts for every school. The best time to figure out the right number is long before the technology has been purchased. Indeed, the best time to figure it out is when the lists of devices to be purchased are nearly finalized.

Get the vendor power specifications for everything and work with your local electric company (or electrical services companies) to audit your building’s power supply and determine if it is sufficient. If not, the electric company can tell you what you’ll need and how much it will cost to upgrade your electric infrastructure.

It is not just a matter of bringing power to the building. How the building is wired is crucial, too. Some types of old wiring simply cannot carry the juice needed for the modern classroom, or the rooms may have an insufficient number of electrical outlets for all the devices that will be used in them. Before spending money on technology, you must know if the infrastructure is up to the job.

If minor or major upgrades are necessary, think long term. More powerful future computers could need more electrical power. Make sure any electrical upgrades will support computing needs for years to come.

DATA CENTERS

Depending on the needs and the size of the organization that owns it, a data center can be anything from a single room with 5 or 10 computers in it to a 10,000-plus-square-foot facility housing hundreds or even thousands of physical and virtual servers. Full-sized, stand-alone physical servers are being replaced wholesale by “blade” servers, which are essentially servers-on-a-board. Rack enclosures can hold dozens of these blades, which in turn can hold any number of virtualized servers. When data is centralized through virtualization, applications can bridge the gap not only between schools in the same district, but also between schools across the state or country. The number of servers an organization needs is dictated by its requirements for software, storage, testing, development, security, networking and other functions.

Standards exist for every aspect of data center design, construction and maintenance. It is important to adhere to those standards. Education leaders should be aware that information technology personnel likely do not have specific expertise in data center design and operations. Therefore, while the district IT department should absolutely be involved in the planning for a facility, expertise is needed and should be planned and budgeted for.

Up-front capital costs for a data center, even though they can be high, are just the beginning. Operation costs will be much greater than capital costs in the long run, so they must also be estimated, budgeted and planned for. Although servers are not considered part of the facility, they, too, must be updated, upgraded, maintained and
ultimately replaced. Administrators must include these costs in long-term data center budgets.

Data rooms or data centers and the servers they house function as the platform upon which all applications in a single school or district rest. The applications can be anything from word processing programs, videoconferencing software and math games to enterprise resource systems. Data centers also store all data on servers, from student health information to teacher lesson plans to homework submitted online. Some servers will host a district Web portal; others will host and manage e-mail, Web browsing, firewalls, security and every other function needed in a modern school district.

District IT staff will set up sufficient server backups so that no critical data or applications will get lost. Backups will also allow “failover” to another server so that, for example, if one application server fails, users will be switched automatically to another server running the same application.

Data rooms may only cost several thousands of dollars. Data centers can be multi-million-dollar investments. Without them, every computer used in offices or classrooms must run its own software, provide its own storage, and may or may not be backed up. Data centers allow the same applications to be reliably and repeatedly used by teachers and students simultaneously throughout a district. They ensure data backups and security. When properly designed, built, operated and staffed, they are vital and valuable information technology assets for any school district.

**NETWORKS AND CONNECTIVITY**

Without access to the Internet, none of the educational technologies discussed in this handbook would be possible. In the United States, telecommunications companies usually, but not always, provide Internet access. These companies built the high-bandwidth, high-speed optical fiber network that now crisscrosses the nation, carrying ever-increasing volumes of Internet traffic to telephone switching offices or to major facilities like school district data centers.

If a district covers a sizeable geographic area or if it is relatively new, the different campuses may also be connected by optical fiber. A smaller or older district may have only copper connectivity among campuses. Copper cables are only reliable up to 90 or
100 meters (approximately 296 to 328 feet). After that, the signal begins to degrade, meaning that the Internet connection will slow down, or data will get lost, or both.

All existing cable installations should be tested and certified with the networking technology a district plans to use. Some existing cable runs will support high-speed networks, while others may need new equipment components or complete replacement.

Another way of bringing the Internet to a school district or campus is through wireless technology by means of WiFi networks. WiFi requires access points in a classroom, office or library. These small antennae must be physically connected to the school network by cable or optical fiber. WiFi is only truly wireless between the laptop, tablet or smartphone and the access point.

Because of the constantly growing demand for Internet connectivity, school districts often find themselves repeatedly upgrading their network. If possible, districts should plan for the future and get the highest-bandwidth, fastest Internet connectivity they can afford at the time. This at least postpones upgrading for two or three years.

If a district is concerned about a major, long-term interruption in Internet connectivity, contracting with two or more providers through separate on-campus networks provides redundancy. Forsyth County Schools in Cumming, GA, built a dual wide area network, a triple Internet connection, and a robust wireless infrastructure to provide sufficient access to its students.

School districts need not necessarily build and fund all of this network infrastructure themselves. An alternative is “managed services,” in which the district pays for Internet connectivity, but owns none of the underlying technology.

Memphis City Schools, which is the largest school district in Tennessee, went this route when its network could not keep up with usage and the district could not afford to upgrade or replace it. Memphis City Schools signed a five-year managed service agreement with Education Networks of America.

The district no longer owns any of the equipment and does not have to replace or upgrade components of the network. In addition to these hardware savings, the district saves more than $2 million in network support costs.
WHERE’S THE MONEY?

As essential and beneficial as technology is for education, there is no question that it is costly. School districts do not have to raise all the needed funds by themselves. They have a number of options to choose from.

Contracts

A few types of contracts that are collaborative currently exist: term and state, and cooperative. They are all similar in purpose, although their structures differ.

TERM AND STATE CONTRACTS

As the name suggests, term and state contracts operate within a single state. They apply to all state government entities which include school districts. Such a contract begins when one or more of the state government entities identify a major need.

For educational technology, this need can be for any or all of the classroom devices or infrastructure elements discussed in previous chapters. The need can also be for services, such as professional development and training, managed technology offerings like the Forsyth County, GA, district network described in Chapter Four, or software and hardware maintenance and upgrades.

Once the need is identified, verified and validated, the state’s procurement agency releases a request for proposal. Companies vie for the contract by offering advantageous terms, which they are willing to do because the customer base is large. Contracts are awarded for specific durations, which keeps the process competitive and prevents having a winner lock in all state business for too long.

Once contract winners are announced, any state government entity can buy from them. Schools can do so through the state purchasing agency, in cooperation with other districts, or by buying directly. It is usually up to the school district how it makes its purchases.

Through term contracts, schools can obtain equipment and services at much lower costs than if they bought on the open market. Procurement is also greatly simplified, as there is no vendor qualification, competitive bidding or RFP evaluation. The term contract does all of that.

School leaders need not wait for state governments to negotiate term contracts. In Maryland, all 24 public school districts, nearly 100 non-public schools, and the Maryland State Department of Education created their own partnership, the MDK12 Digital Library Project.
The express goal of this partnership was to develop a statewide school purchasing consortium for high-quality, subscription-based, online databases that contained information not available elsewhere. Cost savings for the state due to MDK12 rose from $46,000 in 2005 to $250,000 in 2008. A bill codifying the consortium was passed by the Maryland state legislature in 2009, and then-state Gov. Martin O’Malley signed the bill into effect on May 19, 2009.30

COOPERATIVE PURCHASING

Cooperative purchasing is very similar to term purchasing, except that it involves multiple entities. U.S. Communities (www.uscommunities.org) is a cooperative purchasing organization comprising local and state government agencies, public school districts, higher education and nonprofits from all across the United States. Its buying scope is nationwide, allowing members to get very good prices as they purchase products through its contracts. Almost 42,000 public sector entities in the United States participate in U.S. Communities contracts, which annually total more than $1 billion for products and services.

Here is a list of cooperative contract organizations. It is by no means comprehensive.

- Western States Contracting Alliance, www.aboutwsca.org
- Educational & Institutional Cooperative Purchasing, www.eandi.org
- MiCTA (originally Michigan Collegiate Telecommunications Association, but the organization is now national), www.mictatech.org
- United States General Services Administration, www.gsa.gov
- PEPPM, www.peppm.org
- U.S. Communities, www.uscommunities.org

Use the preceding list of cooperative contract organizations as a starting point for finding one or more such organizations that your state or district belongs to or could join.

Federal Elementary and Secondary Education Budgets

The final fiscal year 2010-2011 elementary and secondary education federal budget was reduced by just 4.2 percent from 2009. All education funding, not just for elementary and secondary schools, suffered a two percent cut between the initial and final 2010-2011 appropriations.

- 2010-2011 Final Elementary/Secondary Budget: $37,260,501,000.31
- President’s proposed 2011-2012 Elementary/Secondary Budget: $15,377,180,000.32

The largest technology-specific line item in the president’s proposed 2011-2012 elementary and secondary education budget is Race to the Top. This $4.35 billion stimulus program was re-authorized for 2010-2011 at $698.6 million as part of the regular elementary/secondary budget.33

President Obama proposed $900 million to fund a new Race to the Top program
in 2011-2012. It would create incentives for reform at the state and local level to reduce achievement gaps, improve student achievement, and improve high school graduation and college entrance rates. Race to the Top would encourage effective educational policies and practices while discouraging ineffective ones. Finally, it would encourage better student performance while simultaneously saving money.34

Secondary and elementary education’s second-largest 2011-2012 technology-specific line item is Investing in Innovation (i3), which started out as a $650 million stimulus item.35 It, too, became part of the regular 2010-2011 budget, funded at $149.7 million.36 For 2011-2012, the president proposed $300 million in funding for the new i3,37 which will focus on STEM subjects.38 Its objective is to fund the development and validation of still-unproven new practices, strategies or programs that could improve student performance.39 Practices, strategies and programs that have already been shown to better student performance would also be funded.40

Now we come to the extremely popular and successful Enhancing Education Through Technology (EETT) program. EETT was ostensibly cut for 2010-2011,41 but the president’s fiscal year 2011-2012 budget proposes that it will be “consolidated,” along with 15 other education items, into the new Effective Teaching and Learning for a Complete Education program.42 The president’s fiscal year 2011-2012 proposed budget for Effective Teaching and Learning is $835.5 million.43

Effective Teaching and Learning for a Complete Education is further divided into three subprograms, with funds to be awarded through competitive grants:

• Effective Teaching and Learning: Literacy
• Effective Teaching and Learning: STEM
• Effective Teaching and Learning for a Well-Rounded Education44

All three subprograms are described as “innovative.” When used in government education budget documents, “innovative” means technology.

In particular, the third subprogram will use funds “to strengthen the use of technology across the core academic content areas.”45 The language for all three subprograms, but especially the third one, echoes the purposes of the EETT grants, which were intended to help integrate technology into core academic subjects. Although a proposed budget is a moving object, if Effective Teaching and Learning for a Complete Education survives the brutal budget approval process, educators may find that EETT is alive and still fairly healthy, just disguised under a new rubric.

Professional development for teachers and school leaders at the school, district and state level, while not specifically focused on technology, is certainly essential to the integration of technology into K-12 education. For the rest of the 2010-2011 fiscal year, such programs that relate to technology are funded as follows:

• Teacher incentive grants—$399.3 million
• Transition to teaching—$41.1 million
• Teaching American history—$45.9 million
• School leadership—$29.1 million
• Advanced credentialing—$0

For 2011-2012, the president proposes combining these programs along with several others into three new programs:
• Effective Teachers and Leaders State Grants—$2.5 billion
• Teacher and Leader Innovation Fund—$500 million
• Teacher and Leader Pathways—$250 million

In the 2010-2011 federal budget, all elementary and secondary funds are discretionary. Most funds relating to technology, including those focused on professional development, are awarded through competitive grants. Only two are based on formulas: Improving Teacher Quality State Grants and Race to the Top. This could change for the 2011-2012 budget, but funding methods usually remain the same across budget years.

Grants.gov is the central clearinghouse for all information on federal grants. The site not only lists all federal grants by agency and program, but it also explains how to determine eligibility, apply and write a proposal.

**Partnerships**

Partnering with philanthropic or business organizations is a time-honored way to obtain funds for education. Grantmakers for Education (www.edfunders.org), an organization of 260 nonprofit and business members that provide grants from preschool to college, provide an in-depth look at the grant making community. The largest category is private philanthropic foundations at 35 percent.

According to the organization’s 2010 member survey, the grantmaking community’s funding priorities fall in this order:
• Improving outcomes and increasing opportunities for the most disadvantaged
• Investing in educator professional development and other human capital strategies for improving instruction
• Reforming school systems to promote college- and career-readiness
• Early learning and literacy as keys to long-term success
• Providing learning and support beyond the school day
• Supporting innovation

By itself, technology is not a top goal, but 61 percent of local or state-based grant funders and 44 percent of national or international funders provide grants for STEM education. Digital and online learning garner 23 percent of the grants from local and state-based funders. These areas receive 38 percent of the available funds from national/international organizations.

Lists and directories of state and national charitable organizations can easily be found by searching online. One starting point is The Foundation Center (http://foundationcenter.org/).

Each foundation and nonprofit has its own goals. To apply for a grant, your school district’s aims must align with those of the organization. Alignment may not at first be obvious, so do not mark off an organization too quickly just because its goals do not at first seem to match your district’s.

The next steps in the grant-acquiring process involve applying for the grant, which typically involves writing an extensive proposal. Every organization will have guidelines
for preparing proposals, which should be assiduously followed.

Partnerships with businesses may involve direct funding, but they can also take many other forms. If direct funding is your goal, the process will be very similar to that described above for nonprofit organizations. A company will have goals that should align reasonably well with yours, and you will likely have to apply for funds by writing a proposal.

Local or national companies may also be willing to donate equipment, learning materials, instructional support, services and expertise to school districts in exchange for the good publicity it brings them or to interest students in STEM careers.

Yet a third form school-business partnerships can take is leasing or discount sales programs. School districts can “negotiate leasing and other deals with vendors, spreading costs over several years,” said Instructional Technologist Pamela Livingston in Education Week Digital Directions.53

They can also arrange discount sales programs, as Palisades School District did in Pennsylvania. When the district set up a “bring your own technology” program, it also negotiated agreements with two technology providers so that “the whole community can receive a discount on devices,” said Gary Adams, director of technology.54

Partnerships need not be limited to obvious private sector sources, such as technology companies. Any company can be a source for help of some kind. OneCommunity is a nonprofit organization that connects nonprofit and public organizations in Northeast Ohio — including libraries, schools and hospitals — to a fiber-optic network. In Cleveland, more than 115 public schools use the network.55

Universities and colleges can be tapped for K-12 partnerships such as the one created in 2008 between the Eugene School District and the University of Oregon. Through the Technology Integrated into Learning and Teaching (TILT) project, the university provides professional development for the district’s teachers, focused on methods for integrating technology into K-8 reading and writing instruction.56

Building good public-private partnerships takes leadership, commitment, trust, communication, negotiation and people skills. Collaborative partnerships may or may not involve a contract, but they are established to meet common goals, such as improving STEM education to simultaneously improve school outcomes and meet businesses’ needs for technology-savvy employees.57

**Shared Services**

According to the Chief Information Officers of the States, IT shared services means that a single government entity provides IT services to other government entities.58 For example, it is not uncommon for a city to have an accounting system, enterprise resource system, data center or other technology asset that can be shared with the county in which it is located, or vice versa. Similarly, one state agency can provide other agencies
or local governments in the same state with IT services. In most cases the organization providing the service charges a fee. Despite paying the fee, the organizations using the services still pay less than if they had to run the service themselves.

School districts are looking to Google services, like their app suite, as a cost-effective and low-maintenance shared services solution. Maine Township High School District 207 in Illinois adopted Google Apps Education Edition, a free, integrated suite of communications and collaborative tools that includes Gmail, Google Calendar, and a range of tools for document creation and publishing. The cloud-based solution allowed the district to reallocate an estimated $35,000 to a new e-mail archiving system, and teachers and tech staff now focus their time on teaching and learning instead of trying to fix hardware and software problems. Read more at www.google.com/apps/intl/en/edu/schools.html.

One school district in Fort Collins, CO, is another example of a successful shared services model. The city’s e-mail services are now entirely hosted by the local Poudre School District.59 Before anyone ever thought about a shared services agreement, the city of Fort Collins was planning to upgrade its existing e-mail system to Microsoft Exchange. After exploring a number of options, the city discovered that the school district’s e-mail system already ran on Microsoft Exchange. Furthermore, the city employed 1,800 people who needed e-mail, and the school district was already providing e-mail to approximately 30,000 students, faculty and staff.60

A feasibility study showed that PSD’s e-mail system had plenty of capacity to host the city’s employees’ e-mail and the three domain names the city used. After additional study, PSD was also able to accommodate the security and other concerns that the city had.61

The city paid a one-time transition fee of $170,000 to cover Microsoft licenses for its employees and also purchased a physical and virtual server. Fort Collins pays the school district $20 per seat, per year for the e-mail service. It can renew the contract each October. The city expects to save $55,000 per year by going to the hosted solution.62

Although $20 per seat annually for 1,800 employees is not a significant sum, the city, school district and surrounding Laramie County were looking for other ways to share services.63 Those could bring in more funds to PSD.

If your school district has excess capacity in a technology asset, you may wish to investigate a shared services arrangement. Such an arrangement could be negotiated with many government entities, such as other school districts, local city or county governments or agencies within them and hospitals.

**CONCLUSION**

This document was designed to help educators and administrators successfully make technology an integral part of education. It discusses how to integrate technology into education, what the ideal educational ecosystem includes, why professional development is critical and what infrastructure is necessary. Finally, it lists funding opportunities and strategic partnerships that enable schools and districts to make it happen. Roadmaps and success stories along the way provide tangible examples to follow. It is the hope that after reading this, you will have the knowledge and direction to begin — or continue — leading your schools down a path to the ideal educational system.