One-to-One 2.0

Building on the “Bring Your Own Device” (BYOD) Revolution

Produced by converge

For additional copies or to download
this document, please visit:
www.convergemag.com/BYOD-handbook

One-to-One 2.0

Building on the “Bring Your Own Device” (BYOD) Revolution

Table of Contents:

Introduction

In homes, workplaces, college campuses and K-12 schools, people are increasingly weaving mobile devices and mobile applications into the way they live, work, play and study. From communicating via e-mail or Facebook (the most popular app across all mobile systems)[1] to checking weather and traffic reports, keeping up to date on news through any number of online news sites, shopping and booking travel, videoconferencing via Skype, collecting data for a science experiment, learning a foreign language, researching a historical topic, and the list goes on — mobile applications can serve a vast array of needs.

About 40 percent of today's younger teens (12-17) have smartphones; over half (54 percent) of adults aged 18-24 and 62 percent of those aged 25-34 own them.[2] Since early 2010, tablet adoption in the U.S. has been remarkably rapid, with 11 percent of the population now using them, according to the Pew Research Center.[3] Sales are projected to continue to soar in coming years as rising numbers of users turn to tablets not just for e-mail, games and browsing, but for content creation. Morgan Stanley research, published in February 2011, shows that 20 percent of tablet users today use them to regularly create and edit files (as compared with 34 percent of netbook owners and 56 percent of laptop owners).[4] The number of tablet owners creating files is expected to increase as new mobile applications and faster processing speeds make this easier to accomplish. Tablet apps already include mobile versions of word processing, spreadsheet and presentation software. So what does this mean for schools? In an effort to prepare students for jobs in a more high-tech, global economy, as well as to take advantage of the type

of learning digital technology makes possible, schools have sought to provide computers and other digital tools to students. The goal in recent years has been "one-to-one" computing — that is, a school providing one computer per child, so that instead of students waiting in line to share a limited bank of school computers, each child has unfettered access to a computer of his or her own during class. Or, as mobile technology has advanced, to provide each child with a mobile device, to use in school, if not also at home.

Yet many schools simply haven't been able to afford such a hardware investment, even with the dropping prices of mobile technology (which advances so rapidly that devices are quickly outdated). One answer, now beginning to pick up steam as more districts give it a try, is to let those students who own mobile devices bring them into school, connect to the school's network and use them in class.

This bring-your-own-device (BYOD) approach raises many questions, in addition to promising many benefits. How do you know if such a policy will work for your school? What do you do about kids who don't have devices? Will teachers accept this change in their classrooms? Is your broadband service strong enough? If not, can you afford to upgrade? In other words, how can you best put such a program into place?

We talked to school administrators and technical officers to find out the best practices they have learned from their BYOD implementations. Their advice is gathered here, along with checklists to help guide you on the path to BYOD.

What is BYOD?

BYOD is also sometimes known as BYOT (bring your own technology) or referred to as "the consumerization of IT." Within education, it refers to the practice of allowing students to bring their own mobile devices to school that are capable of connecting to the Internet, and can include everything from laptops to netbooks, tablets, smartphones, PDAs, e-readers and gaming devices.

"It's letting kids use the tools of their generation to accelerate learning," says Bailey Mitchell, chief technology and information officer for Forsyth County Schools in Georgia, which has offered a BYOT program for four years.[5]

In a typical BYOD classroom, the array of devices varies tremendously as students work through common tasks. Some students might have more than one, shifting attention between a tablet and smartphone as assignment needs dictate, while other students use a single game device, laptop or netbook. Students might film each other with phone cameras solving problems at a whiteboard, then post the video to a classroom wiki to share. Other students videoconference with peers in other classrooms about a collaborative project.

Outside the classroom, students turn to their devices while at home, sports practice or wherever they might be to work on assignments, check messages from the teacher, view test grades and so forth. Those on field trips use mobile tools to collect pictures and other data, sometimes incorporating GPS technology.

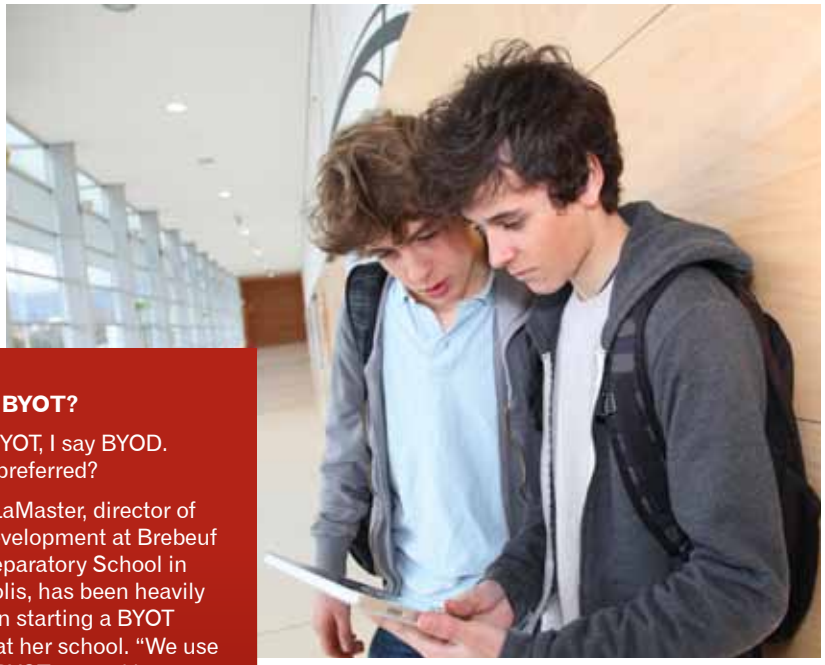
Just as uses for mobile devices in education are varied, so are the ways schools construct their BYOD policies. Some allow students full use of devices at school — not just in the classroom, but in corridors, cafeterias and other common areas, both inside and outside campus buildings. At Hinsdale Central High School in the Chicago suburb of Hinsdale, rules were eased in 2011 allowing students to use cell phones, laptops and other mobile devices between classes, during lunch periods and study halls, and in some classrooms (those in which teachers have incorporated mobile technology).[6] Others require mobile devices to be turned off and stowed away when students are not in class, and to only be used for educational purposes (no Facebooking on school time, for example).

A related mobile device strategy is BYOL, or bring your own laptop, in which students buy and bring in only laptops that meet specified requirements. Such plans typically exclude smartphones and tablets.

BYOD allows schools to achieve one-to-one computing and the benefits of mobile learning without the school having to purchase and maintain devices for every student — an appealing option in times of ever-tighter education budgets. Yet as a relatively new concept in K-12, it is not in wide use; indeed, schools today are still more likely to ban cell phones and similar devices than to encourage them to be brought to class. Common Sense Media found in 2010 that 69 percent of high schools banned cell phones, for example.[7]

In 2010, Project Tomorrow released a survey of 3,500 K-12 administrators and CIOs that found 35 percent favor BYOD, with 65 percent opposing.[8] However, the survey reflects data compiled in 2009, pre-dating the introduction and popularization of tablet devices. It also gives the opinions of IT directors, who may be more concerned with network control and access issues, rather than the views of instructional technologists, who can be more focused on curriculum improvement and technology integration.

More current research shows interest in BYOD is high — and growing. From a sample of 30 interviews conducted by the Center for Digital Education in 2011, eight districts (27 percent) expressed interest in BYOD initiatives. Meanwhile, tech leaders at schools with BYOD policies already in place often receive inquiries about their programs, speak at conferences to packed rooms and host visits from administrators at other districts.



BYOD or BYOT?

You say BYOT, I say BYOD. Which is preferred?

Jennifer LaMaster, director of faculty development at Brebeuf Jesuit Preparatory School in Indianapolis, has been heavily involved in starting a BYOT program at her school. "We use the term BYOT around here — it's not just the device but all resources students bring into the classroom."

Similarly, Mitchell says the Forsyth district debated BYOT vs. BYOD for its initiative, before settling on BYOT.

"Philosophically it's really not about the device per se," he explains. "We didn't want people to get preoccupied by 'device.' We wanted to be more encompassing of possibilities."

But so far, LaMaster and Mitchell are outnumbered, at least if you go by Google Trends, which show BYOD beating BYOT by about a four-to-one margin.[11]

"Clearly most districts do not engage in BYOT, but almost all districts have probably had conversations not only at the school but at the district level about readiness for it," says Mitchell. "Technology departments are being pinged as to feasibility. Parents are asking questions of a particular school and those are rolling up. It's certainly something that's on everybody's discussion agenda. Most are not allowing for this just yet — but most are fully aware and engaged in discussions in and around what it would look like for them."[9]

The Project Tomorrow survey showed that a majority of parents (67 percent) would purchase mobile devices for their children to use in school and 66 percent supported online textbooks, with 61 percent supporting the use of mobile devices to access these online textbooks. Students also express a strong desire for mobile technology in the classroom. More than half — 53 percent — of middle and high schoolers say not allowing smartphones or MP3 players is the biggest obstacle to using technology in school.[10]

Who's Using It?

It's difficult to say how many schools around the U.S. are implementing BYOD, but examples exist from across the country, in large schools and small, urban and rural, public and private, elementary as well as secondary. Schools in other countries are also implementing BYOD.

BYOD is not just a burgeoning phenomenon in K-12 and higher education (where it is commonplace), but also in the worlds of business and government. As more people are acquiring mobile devices, they are using them not only in their personal lives but also professionally. Applications in a wide range of fields are speeding adoption.

Businesses

A majority of businesses now allow employees to bring their own devices to work and to access employer networks, studies show. Aberdeen Group's March 2011 mobility management survey found 72 percent of organizations permitting employee-owned devices for business purposes.[12] IBM, as just one example, began allowing employees to connect their personal phones and tablets to the corporate network in 2011 and expected 200,000 employees to be doing so by the end of 2012.[13]

Government Agencies

While government traditionally has been locked down and more controlling in its approach to computer technology, in recent years the economic advantages of a move to mobile, especially when devices are purchased by employees, has resulted in a change of attitude.

Former Federal Chief Information Officer Vivek Kundra in February 2011 proposed to give federal workers a $2,000 subsidy to buy their own laptops and smartphones — a "cloud first" policy projected to save $5 billion annually in hardware investment and maintenance costs.[14] (New CIO Steven VanRoekel says he also supports this policy.)[15] Technology managers at the VA and NASA both predict BYOD will be implemented at their agencies within the next several years.

"In our experience, when students do not have the same device, same software, same everything, teachers are forced to think differently about managing learning."

Bailey Mitchell,
Chief Technology and Information Officer, Forsyth County Schools, Ga.

10 Benefits of BYOD

1. HELPS TO ACHIEVE ONE-TO-ONE COMPUTING AT LESS COST

For many school districts, one-to-one computing has been an unattainable goal due to lack of funding. Allowing students who already have their own laptops, tablets, smartphones or other devices to bring them to school gets districts closer to one to one without having to buy or maintain hardware. It then becomes easier to afford equipment for students who can't provide their own. (See equity discussion, page 29).

2. TEACHES PROBLEM-SOLVING, CREATIVITY AND OTHER 21ST-CENTURY SKILLS

When schools issue students identical devices with identical software packages, this may "rob the students of the benefit of learning how to use their tools productively," cautions Mitchell. In a BYOD environment, on the other hand, students are bringing a plethora of tools to the table, some of which may work better than others at different tasks. Students learn, as they may need to in their future careers, how best to adapt their tools to the job at hand.

"BYOT empowers students to use their devices in new ways to produce original content and solve problems," says Mitchell. This helps them develop "innovative computational thinking."

Schools with one-to-one initiatives in which districts have provided all students with the same device and software run the risk of "replicating a very traditional assignment in a digital way" rather than doing something new, says Mitchell. BYOD, on the other hand, "makes teachers think differently about the way they conduct instructional activities" and gives students the ability to practice 21st-century skills.

3. MORE ENGAGED STUDENTS

Those who oversee BYOD programs say students who are using their own mobile devices are more engaged in learning. They are, after all, using the tools they are most comfortable with in their personal lives.

"In our experience, given the choice, students prefer to use their own device rather than one provided to them by the school system," says Mitchell.

Lenny Schad, CIO of Katy Independent School District in Katy, Texas, which provides smartphones to fifth-graders and began allowing students to bring in their own devices in 2011, says student engagement levels are remarkable.

"We had veteran teachers — 20-year teachers — saying that they had never seen engagement in their classes like they saw when they used Web 2.0, or when they saw the kids using the mobile learning devices."[16]

4. HIGHER ACHIEVING STUDENTS

Extensive evidence exists showing that students who are more engaged and motivated are more likely to be successful learners.[17] For example, studies have shown a direct link between levels of engagement and achievement in reading and mathematics.[18] National Research Council studies in 2000 and 2003 show a correlation between disengagement and dropping out of school, especially among poor, minority youth.[19]

Mobile devices appear to increase student engagement. In one study in 2008, high school algebra students in Onslow County Schools in North Carolina were given smartphones to use in class and at home; test results showed gains in math achievement, with greater student engagement cited as one factor in the rise.[20] At St. Marys City Schools in St. Marys, Ohio, classes with and without mobile devices were tested; students who were allowed to use devices scored higher in geometry. Other evaluations showed gains in social studies, reading and writing for those students using mobile devices.[21]

5. ANYTIME, ANYWHERE ACCESS

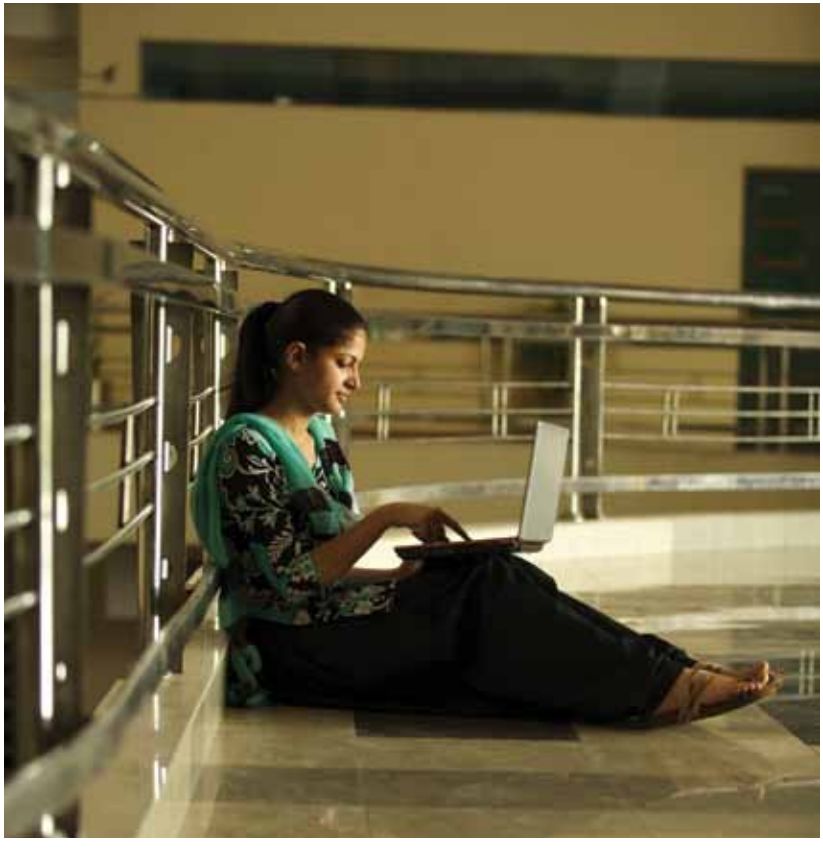
Students, teachers and staff are able to connect to the network and to each other without regard to time or place. Teachers can collaborate more easily with other teachers when outside the school grounds, as well as keep in better touch with students, when needed.

6. GREATER COLLABORATION

Mobile devices make for easier group work than traditional desktop computer labs.

"What we have experienced is that when the device is smaller and portable, students are able to collaborate and work together with greater effect than trying to gather around a row of desktop computers tethered to an Ethernet port in the back of the room," says Mitchell.

Teachers become facilitators, helping foster collaboration among students as they seek and evaluate information.



7. BETTER STUDENT CARE OF DEVICES

When a student is responsible for his or her own device, school administrators say they are less likely to treat them carelessly than if they are school property. At South Forsyth High School in Georgia, technology-related discipline offenses dropped from 400 in 2008 and 2009 to just four in 2010 — the first year of the school's BYOT program.[22]

8. SAVES MONEY ON TEXTBOOKS

If every student has a mobile device he or she can take home, these can be used as e-readers for textbooks or other digital content — and heavy, costly print editions do not need to be purchased. This can save thousands of dollars for districts. For example, a 2011 study by Simba Information found districts saving more than $3,000 annually in printing and textbook costs by implementing mobile device use in a single classroom.[23] In Roslyn Heights, N.Y., a purchase of 47 tablet computers for two high school classes at a cost of $35,000 is expected to save $7,200 annually in textbook and printing costs.[24]

9. CUSTOMIZABLE FOR DIFFERING LEARNING STYLES

Letting students use different devices lends itself to customized assignments, which can play off the strengths and learning styles of each child. So, for example, a child with a laptop may write a more traditional paper or report about a topic, while one with a smartphone may choose to create a video answering the same question; another child with a tablet might produce an animation, storyboard or blog post.

"When teachers see the opportunity for different tools to be used instead of traditional paper and pencil, this is where they're bringing it in," says Schad. "It's really tapped into that different shaded learning style that we know all these kids have. Once we allowed children to do their homework in multiple avenues, that's when we started to tap into these different shaded learning styles, and that's where we saw creativity go through the roof, and that's where we saw engagement go through the roof because these kids had multiple avenues to do their homework rather than just on paper and pencil."

10. CREATING LIFELONG LEARNERS

Using mobile devices that go from home to school can create a different relationship between student and school, and indeed between a student and his or her self-identity as a learner. In the past, school was between 8 a.m. and 3 p.m., and some students built up a perception of school as drudgery. Now that line between in-school and out-of-school is blurring and technology is helping that. Students get to be the same curious learner both in and out of school, which is gradually breaking down the concept of learning being a chore. Students are becoming self-motivated lifelong learners.

Are You Ready for BYOD?

Before Jennifer LaMaster answers any technical questions about the BYOT pilot Brebeuf Jesuit Preparatory School in Indianapolis, Ind., rolled out in 2011, she stresses why this route was chosen. Its goals include creating "an environment where students, faculty and staff have access to all the resources necessary for teaching and learning," as well as developing education literacies and providing personalized technology tools.

> "The single biggest question that I ask every district that calls me for advice is, 'Why do you want to do it?'"
>
> **Lenny Schad,**
> CIO, Katy ISD, Texas

Your goals may differ. But it's important to know them — to be clear from the outset why you are considering BYOD and what you wish to achieve by offering it.

"The single biggest question that I ask every district that calls me for advice is, 'Why do you want to do it?'" says Lenny Schad, CIO of Katy ISD. "You have to be able to answer that question — and if it's just because it's what everyone else seems to be doing, then you need to take a step back. The answer had better be coming not just from the technology department, but it better be coming from the parents, the teachers and curriculum instruction."

In short, says Schad, BYOD is not about the device. "The Holy Grail is not about allowing kids to bring it in; it's not a technology initiative that really drives this, but it has to be supported in collaboration with curriculum instruction and the community at large."

Considerations

- Does BYOD fit your district's educational vision and goals?
- How would it match up with your student population? What percentage are likely to have a device they can bring in?
- What is the current state of your infrastructure? Do you have robust, secure WiFi that can serve the additional devices you will see with BYOD? Can you afford an upgrade?
- Do you have policies in place that allow students to use devices at certain times of the day or in certain areas on campus?
- Will your teachers support a move to BYOD?
- Do you have strong leadership to help sell the concept and guide its implementation?
- How will you support your faculty as they adapt their pedagogy to best make use of a BYOD environment?
- How can instruction be improved by adopting BYOD?

Planning for BYOD — 10 Checklists to Help Make the Move

BYOD isn't something to jump into. It requires careful planning; some school districts report spending years preparing teachers and systems for this shift. A variety of considerations need to take place, from initial goal setting to infrastructure review to device management services.

The following is by no means an exhaustive list of 10 topic areas to ponder as you decide whether, and how, to implement a BYOD plan, but it will definitely get you started in the right direction.

1. EDUCATIONAL OBJECTIVES

The first step in planning is to know the outcomes you seek. The following are all achievable through BYOD.

- Training students to be good digital citizens, so they know how to live responsibly in today's digital world
- Teaching teamwork and collaboration skills
- Fostering creativity
- Honing problem-solving skills
- Promoting higher-level thinking
- Improving student access to technology
- Integrating technology into the curriculum
- Raising achievement levels in core content areas

2. CAPACITY PLANNING CHECKLIST

Charles Thacker, CTO at Farmington Municipal Schools in Farmington, N.M., says readying a district for a significant influx of wireless mobile devices is akin to building a new highway.

"We don't want them driving down a dirt road full of potholes. A fast car on a poor road doesn't do you any good."

At Farmington, students use school-supplied fast cars — that is, laptops. In a BYOD version of this analogy, students are also motoring in semis, SUVs, sedans and smartcars — in other words, vehicles of all makes and models. Ideally, traffic moves smoothly: no crashes, no cars knocked off the road because the pavement suddenly runs out.

To achieve the smooth road at Farmington, the school beefed up its local area network, increased its wireless area network capacity and speed, and

replaced its wireless local area network (WLAN) with a more robust model. Doing so boosted bandwidth and "made a huge amount of difference as far as connectivity," says Thacker.[25]

Kyle Menchhofer, technology coordinator at St. Marys City Schools in St. Marys, Ohio, says he knows about a school that switched to BYOD but was only able to accommodate 279 of the anticipated 400 to 500 devices students brought in before it choked. In order to avoid this happening when St. Marys rolled out its BYOD program in November 2011, the district expanded its bandwidth to 20 MB and plans to expand it to 100 MB in 2012.[26]

Wolf Creek Public Schools in Alberta, Canada, found that it needed to add several hundred more wireless access points.[27] Forsyth County Schools in Georgia doubled bandwidth, from 1 MB per second to 2, and tripled Internet access (from 500 MB to 1.3 GB). It also upgraded to the N wireless standard, at a cost of $1.4 million.[28]

Considerations

- Have you surveyed students or parents to get an idea of how many devices might be brought to school? (Keep in mind that some students may have more than one, while others will have none.)
- How many personal devices might faculty and staff bring?
- Do you have an estimate of the maximum number of devices that might be used at any given time?
- How do you anticipate provisioning these devices for access into the network?
- How will IT be impacted when supporting these devices?
- Have you considered self provisioning options?
- What apps do you anticipate running? Will they include multi-media files, especially streaming video?
- What other services do you plan to provide that could affect capacity?
- Do you have management or monitoring software to adjust "quality of service" so that essential uses, such as online state testing, remain a top allocation priority during peak usage times?
- Are you planning to cover all campus areas where students congregate — gym, cafeteria, library, common areas outside school, buses?
- Is your infrastructure resilient, flexible and redundant? (Redundancy means that you have back-up systems in place so that WiFi service is not interrupted. Mitchell at Forsyth County Schools says the district achieved complete redundancy, so that if an outage occurs, education is not disrupted; this he deems essential.)
- Does your wireless meet the 802.11n standard? This "N Standard" means connections are made at a speed up to 300 Mbps, up to six times the rate for the previous 802.11g standard. It also provides better range, density and dual banding to sustain bandwidth integrity between 2.4 and 5 frequency ranges

(older student devices use the 2.4 range, while newer ones are more likely to use the 5 range).

- In terms of electrical capacity, do you have enough outlets and power sources for students and others to charge devices?

3. INFRASTRUCTURE PLANNING

Schools offering BYOD must have a robust WiFi network — that's not up for debate. But there are options for how a network is structured.

For example, some schools may choose the "Starbucks model": a public WiFi set up so that the district's internal wireless network, with business files and so forth, is not accessible. Instead, students can hop onto the WiFi system when on campus and from there access the learning management system, Internet browser and whatever else has been filtered and approved for their use, such as Google Apps or other cloud-based software. Katy ISD in Katy, Texas, uses this approach. Note that public WiFi networks can be configured to also deny access to other WiFi networks while on school grounds.

Another method is to set up a private network, such as a VLAN, which students will log into and receive authentication. Again, with this method, the district's private data remains inaccessible to students, while filtered browsing, screened apps and other services are allowed.

In both set-ups, says Schad, "you have to quickly adapt to bottlenecks and make sure that you have the appropriate bandwidth and that you have done some trending to understand that as this grows in popularity, your bandwidth needs are going to continue to grow."

"BYOT is the disruptive innovation needed to move us past banning, past worries about student-owned devices being used to fuel instruction and move us to personalized learning, differentiated instructional strategies, and to focusing on the learning and not on the tool."

Bailey Mitchell,
Chief Technology and Information Officer, Forsyth County Schools, Ga.

Firewalls also may need to be enhanced. At Brebeuf Jesuit Preparatory School, a BYOD implementation included a firewall upgrade to allow it to handle up to 1,500 devices. The school has about 800 students and 120 faculty and staff members.[29]

When mobile devices are primarily laptops, they have more power and are better able to respond on a wireless network. But other mobile devices, such as tablets, typically have less powerful radios and may not be able to send responses, which limits classroom interactivity. (In other words, their "receive sensitivity" is less.) More wireless access points may be needed closer to where the devices are used — perhaps within each classroom, instead of trying to serve a block of four classrooms, for example.

Deploying one access point per classroom can satisfy density issues, but creates a challenge with co-channel interference and signal-to-noise. Care should be taken with regard to access point selection and wireless technologies to avoid these density challenges. Single channel WLAN architectures, for example, do not suffer co-channel interference.

Providing wireless to large outdoor common areas, such as football fields or parking lots, can be handled through wireless mesh technology, which allows access points to backhaul the signal from one point to another. Indeed, as students, staff and faculty move about the campus, end-point bandwidth as well as point-to-point support throughout the campus and district need to be considered.

Scalability is another important issue in planning an infrastructure upgrade. Consider that while students may bring one device today, tomorrow they may have two or more, and may use them simultaneously — perhaps a tablet for viewing an instructional Web-based video and a phone for simultaneously adding notes into an online document file, for example.

Regardless of your deployment (local, centralized, hosted or cloud) it is important to have high availability of your wireless solution, which may include

a service level agreement (SLA) from your service provider, to assure you of reliable connectivity and acceptable mobile performance.

Troubleshooting wireless network issues can be tricky (something as temporary as the use of a microwave oven can disrupt a signal). Outsourcing management of all or part of your network services might be a solution. Schools should also take advantage of a vendor's management tools. Having a good set of troubleshooting tools on site is a real benefit to schools. If the tools are simple enough, then resolution to problems can occur without delay of working with a second resource provider. Management "help desk" software can also serve to maintain systems and identify problems.

Considerations

- Is your firewall sufficient to handle the number of devices anticipated?
- Are servers virtual or physical? Are they adequate?
- Do you have enough access points, either physical or virtual?
- Have you reviewed mobile device management solutions, which allow you to see and control all devices connected to your network?
- Are there available outsourcing options that may work for any aspects of your IT operation?
- Is your infrastructure solution scalable?
- Does your configuration avoid bottlenecks and single points of failure?

4. COMPLIANCE

K-12 schools in the U.S. are affected by regulations ranging from state to federal, and these can impact how you implement your BYOD plan.

State Laws and Regulations

In Georgia, laws covering electronic communications devices in schools were written during the pager era and don't reflect current technology. They may not permit personal electronic devices being used in school, says Mitchell. His district has applied for a waiver from the Georgia Board of Education from this rule.

In California, the "Williams Act" ensures equal access to instructional materials and facilities. If you are requiring digital devices be used in class and/or at home but are not ensuring needy students have equal access, this could be an issue.[30]

Federal Laws and Regulations

- **CIPA (Children's Internet Protection Act)**[31] — If you are seeking federal E-Rate funding on telecommunications services, your school must be in compliance with CIPA, which means your Internet content has to be filtered so that children are protected from inappropriate material.

- **FERPA (Family Educational Rights and Privacy Act)**[32] — Protects the privacy of student records.

- **COPPA (Children's Online Privacy Protection Act)**[33] — Requires parental consent for the online collection of information about users under 13.

Beyond these regulations, other areas of the law concerning mobile technology are less clear.

Say a student brings his phone to class and uses it to post bullying messages on Facebook or to access porn sites and show them to other students. Can a teacher legally confiscate his phone? How about search its contents?

Districts often write acceptable use policies (AUPs) or other guidelines that students must sign before bringing their phones, tablets and other devices to school, which may include language stating that bringing the device to school constitutes giving the school authorities permission to access its contents — just as they would have the right to search a student's backpack.

However, the law is still murky, cautioned Georgia attorney Phil Hartley in a speech given at a BYOT Summit held at Kennesaw State University.[34] Tread carefully — and consult with your school system's attorney if you are uncertain how the law may cover your BYOD policy.

Also think carefully about instituting an entirely separate AUP for BYOD devices, rather than incorporating it into your overall expectations for student conduct.

At Forsyth County Schools in Georgia, a separate BYOD protocol and usage agreement is given to students and parents; the agreement must be signed before a device can be brought to school.[35]

Considerations

- Does your AUP cover student-owned mobile devices?
- Is your BYOD usage policy consistent with other AUPs in your district?
- Has your attorney reviewed it to be sure it is adequate?
- Are you in compliance with relevant regulations in your state?
- Is your Internet content filtered sufficiently?

5. SECURE AUTHENTICATION

At Wolf Creek Public Schools in Alberta, Canada, a BYOD program was launched in 2009. Soon after, administrators noticed a problem: students trying to use their mobile devices were encountering lengthy wait times as they signed on, a result of an inefficient authentication process. These delays were hampering classroom operations as teachers and students waited for devices to become available on the network.

"Two or three minutes may not seem like a long time, but if you're a teacher in a classroom, you hate to give up any instructional time to a technical impediment," said Gary Spence, assistant superintendent.[36]

The district tweaked its wireless and network access control products, so that now connection takes place within a few seconds for some devices and under a minute for others. In addition, tech staff provided contact information for teachers, so they could quickly call and resolve any new issues or problems that might arise.

Authentication can be a challenge in BYOD. By definition, BYOD means devices of all types are accessing the network, and users are moving from location to location within a school campus or are logging in from areas outside school — at home, on a bus or from a coffee shop. Each device must be recognized on the network and authenticated, in order to preserve security. Authenticating the user alone is not sufficient. But how often does a user need to re-authenticate? Can the process be shortened in a way that maintains security, but also enhances efficiency?

One management solution is Active Directory, which is used by St. Marys Schools in St. Marys, Ohio, which began a BYOD pilot in November 2011. Active Directory is a Windows directory service that authenticates users and devices on a network, verifying access privileges and attributes.

Students and teachers at Brebeuf Jesuit Preparatory School authenticate their devices using a school-created username and password. "We know who is on

the network, with what device and at what location at all times," says LaMaster. "Notification of misuse, based on profiles, is sent to IT devices immediately when action is called for."

Considerations

- Will students, faculty and other users be recognized or treated as guests?
- Should you distinguish different classes of users and tailor policies accordingly?
- Should you restrict the use of devices during certain hours of the day?
- How often will teachers, staff and students need to re-authenticate? Could this affect classroom efficiency?
- Is Active Directory a solution for you?
- If you do not already have this infrastructure in place, could you consider another authentication solution?
- Are you considering a guest management option? Keep in mind that when student devices are treated as guest devices, this can be an unnecessary burden for the system and take away valuable learning time in a classroom while students and teachers wait for devices to be authenticated.

6. MANAGEMENT OPTIONS

Desktop virtualization uses cloud-based servers to provide content to students, such as applications and a learning management interface. It is well-suited for a BYOD environment — indeed is the preferred option — because it is device-agnostic and operating system-agnostic; it addresses all the diverse presentations and storage control needed from a vast array of devices, many with little to no secure storage. Students can log into their virtual desktops using whatever mobile device they have and access applications, assignments, messages and other content, all of which is located in a secure cloud. The school's internal network remains protected. This is one management option for mobile devices, but it's not the only one.

At Farmington Municipal Schools, each school has a LAN (which was enhanced to improve connectivity), while the district itself has a WAN (also enhanced to accommodate mobile device demand), says Thacker. More importantly, the WLAN was improved — the wireless devices depend on the WLAN as the first point of entry to the LAN and then to the WAN. The district filters all traffic on its network and mobile devices — regardless of whether they are on or off its network. This is a critical component of having more positive parent support. If laptops are not filtered while off network (like when students are at home), then parents can be less likely to support this type of implementation.

Other options include device management services that can allow a district to track mobile devices as well as to troubleshoot issues and problems (sometimes this avoids having to send a tech out to a location).

Printing

One challenge districts sometimes encounter in BYOD management involves wireless printing from numerous disparate devices.

"Solidifying printing directly from all devices has been a challenge," says LaMaster. Engineers had to find solutions for each operating system.

Other districts, such as Forsyth County Schools, have, at least for now, not allowed student devices to access district printers. "We're looking at printing as an option we might include in the future," says Mitchell.[37]

One way to address network printing issues is to have the print command come from the virtual server, which can print to the appropriate printer, rather than taking commands from a device directly.

Districts should have a print/document management policy for BYOD devices — not just a set of technical procedures, but administrative guidelines for when students can and should have access to printing services. Such policies can simplify printing and document management and, if done properly, save money by having only essential documents printed.

Wolf Creek Public Schools in Alberta, Canada, began a voluntary BYOD program in 2009. During its first month, a fire hit one of the district's high schools, which meant students lost access to computer labs and school-owned devices. Students with their own mobile devices, however, were still able to access the network.

This was a surprise plus in favor of the district's move, but not the reason for the shift. The district chose BYOD for its pedagogical benefits, say district officials. "It's about enhancing and building excellent learning environments," says Assistant Superintendent Gary Spence. "It's not a tech goal; it's a learning goal."[38]

Considerations

- Is desktop virtualization an option for you?
- Do you have cloud-based apps? Could you find cloud app alternatives to software you currently use?
- What type of management service or system do you have? Is it adequate for BYOD needs?
- How have you set up printing services for mobile devices? What controls are in place to eliminate unnecessary printing?

7. DEVICE REQUIREMENTS

"One of the biggest benefits of BYOT is that the devices are not the same," says Mitchell.

But does having a BYOD policy mean you throw the doors open to any type of mobile device students might want to bring? Or do you set minimum standards?

Districts using BYOD vary in approach. Some have a virtualized environment, with apps residing in the cloud that students can access regardless of device

platform. Others install mobile software, which may mean some restrictions or requirements on the type of device need to be put in place.

Forsyth County Schools, for instance, allows all mobile devices — except for one type of gaming device that can't connect to its network.

At Katy ISD, Schad says, "if it's a WiFi-enabled device, they can bring it in and connect. ... I didn't want to specify because there's such a plethora of devices out there that have this capability which can be used when applying Web 2.0 tools to them that I wanted to come up with the broadest of applications that they can be used for."

Other districts, however, give parents and students lists of specific capacities needed for anticipated uses, including recommended hard drive sizes and operating system versions that are required by software the district will install.

"If you are a control freak, you're not going to enjoy BYOT."

Bailey Mitchell,
Chief Technology and Information Officer, Forsyth County Schools, Ga.

One way to determine whether you should set guidelines for devices is to consider what type of applications your students will use. Do you have many Adobe Flash-animated programs or websites that you anticipate having children work with? If so, then you may wish to discourage tablets and smartphones that do not run Adobe Flash.

As part of your planning process, you should test your system and apps with a variety of devices to see if any present particular problems. Also, apps — whether virtual or installed — must be chosen by districts, so policies and procedures need to be in place on how this is to be accomplished: Who evaluates apps to ensure their educational value and suitability? Who does the purchasing? How are apps to be maintained and upgraded?

Another factor that may impact device requirements is how these devices will connect with technology already installed in classrooms. For example, you may have interactive whiteboards, projectors and monitors with which students will interact, using their devices. Policies need to be set to determine the management of such connections. Similarly, teachers may manage content that is sent between their devices and student devices, which may necessitate requirements for certain device capabilities.

Considerations

- Are the apps students will be using device-agnostic (such as cloud-based apps)?
- Will students be heavy users of Adobe Flash?
- Have you tested your network and apps with a wide variety of devices to see if all work properly?

- Who will evaluate apps before installation in the cloud or on individual devices? Who will maintain them?
- Do the technology devices installed in your classroom, such as e-boards, have requirements that could impact the type of devices students bring?
- Do teachers have criterion for devices, based on the interaction they anticipate between student devices and their own?

8. PROFESSIONAL DEVELOPMENT

"It's not the tools that determine whether the learning experience is quality or not," says Mitchell. "Teachers must design transformational learning experiences, using whatever technology is available, in which students are required to go beyond existing information, become information producers and use higher order thinking skills."

In other words, teachers are critical to making BYOD successful. Otherwise, students will have their cars ready to cruise on the fast highway you've provided — but no idea where to go or how to get there.

Given teachers' importance, attention must be paid to preparing them well before mobile learning technology is brought into the classroom. Katy ISD, for instance, spent two years preparing teachers for BYOD.

Teachers should not be expected to know the ins and outs of every device, nor be responsible for them. Once this is made clear, those who have been reluctant may change their views.

"Anecdotally, teachers tell us that BYOT is the easiest technology initiative that they have implemented because it empowers the students to be the technology experts," says Mitchell. Students help each other with problems with their devices, leaving teachers free to focus on teaching. "Technology is a disguise for what the conversation really should be about and that's designing learning for students that requires thinking and creativity."

Professional learning communities and ample time for collaboration help teachers learn ways to use technology to implement the curriculum — and lose any fear or reluctance they may have. Mentor teachers — the tech-savvy among the staff — can be a good step toward bringing the less-tech-oriented along with tech tips, tricks and techniques.

"One of the keys for staff is they need to have a taste of success," says Thacker. "If someone could come in and show them a tiny little thing that you can do consistently, then you gain confidence." To be avoided: having an enthusiastic teacher overwhelm a reluctant one with too much at once.

Another way to handle the plethora of tech tools available is to follow Katy ISD's example and create a "Web 2.0 toolbox," with such tools as Diigo, Edmodo, PBWorks, VoiceThread, Voki and others, says Schad. Teachers were given two years to familiarize themselves with these apps. Those teachers who became comfortable with Web 2.0, he says, became excited about having students bring in Web-enabled devices that could take advantage of these tools.

Another way to encourage enthusiasm by faculty: invite them to visit a Tech Petting Zoo — a term coined by LaMaster for a popular professional development activity she arranged at Brebeuf. "We had every mobile device we could get our hands on," she says. "The idea was to 'pet' the technology and really see what it could do."

After teachers had a chance to experience firsthand what mobile devices could do, they became much more excited about the upcoming BYOT pilot, says LaMaster.

Considerations

- How much time can you provide for teacher training?
- Have you formed professional learning communities within the district?
- Do teachers have time built in to their schedule for collaboration with other teachers about tech issues?
- Are there outside professional development services you would wish to bring in?
- Have you held hands-on informational sessions with teachers to improve familiarity with mobile devices?
- Are you planning professional development sessions that are bite-sized and posted online for teachers to review at their pace and at a time convenient for them? (For example, when a teacher is designing a lesson using a particular tool, he or she could refer to online instructional material about that tool.)

9. ENCOURAGING PARENT BUY-IN

Parents may be understandably concerned when they first learn their child's school is considering allowing them to bring smartphones and gaming devices to class. Some fear the child will lose or break the device; others that the child may be exposed to inappropriate content, either on their own device or another child's.

One way to alleviate parent concerns is to set up clearly defined rules governing how the mobile device will — and won't — be used. Some schools require students to sign agreements before bringing devices; others don't. In any event, a responsible use or acceptable use policy is a good way to ensure everybody understands how to be a good digital citizen at school (see

ITEMS TO INCLUDE IN AN ACCEPTABLE USE POLICY FOR BYOD

- A list of any devices that won't be allowed
- A waiver of liability (so school and district aren't responsible for the device being lost or stolen)
- A discussion of teachers' roles, making clear that teachers are not the tech support for every gadget
- A delineation of parents' roles
- A separate BYOT agreement listing specific rules for use (at Forsyth, students and parents must adhere to the Student Code of Conduct, plus Internet Acceptable Use Policy and Internet Safety Policy, plus must initial every item on a list of BYOT instructions)

Some rules might include:

- no use of devices during tests
- must be in silent mode while on campuses and in school buses
- no non-instructional use, such as texting or making or receiving personal calls
- not to be used for taking photos or videos of others on campus during school hours/activities
- non-educational games should not be brought to school; student will use only appropriate applications
- no use of 3G/4G networks in school
- no attempts made to bypass school's network filters
- no hacking of school sites
- no sharing of devices without written parent permission
- devices will run on their own batteries and be charged prior to bringing to school
- transmission of bullying material or material of a sexual nature will not be tolerated
- use of BYOT prohibited in cafeteria, gym, locker rooms, hallways, bathrooms
- consequences established, such as loss of network and/or technology privileges
- district has right to collect and examine any device suspected of being source of attack/virus infection

(SUGGESTED BY FORSYTH COUNTY SCHOOLS)

"Items to Include in an Acceptable Use Policy for BYOD" on page 27). Device policies also need to be reiterated in other policy-related documents, such as enrollment cards.

Parent meetings should be held to discuss any plan under consideration. This way, parents can speak with you firsthand and you can allay worries or fears.

"One of the things I've said when we get in front of parents is: 'This learning style does not replace traditional paper and pen and textbooks,'" says Schad.

"There is a time and a place for those to be used inside the classroom; likewise, there is a time and place for Web 2.0 tools and BYOD capabilities."

Parents also learn the ways in which BYOD apps can be used in various core curricula, as well as tools they may wind up using themselves at home — such as English as a second language (ESL) capabilities for parents who do not speak English natively.

"ESL is one of those areas we're seeing the devices really being used, and not only by the students but also by the parents at home," says Schad. "The parents can pick up podcasts and vodcasts on this ESL functionality."

At Brebeuf, parents were given a chance to "pet" the technology, much as teachers did (in other words, a Parent Tech Petting Zoo was set up with an array of mobile tech devices, so parents could see for themselves what is possible in the classroom when using mobile learning tools).

Following in-person meetings, parents can be kept up to date via letters, e-mails and posts to the district website. Parent feedback should be sought early and often.

Starting with a small pilot program can be a good idea for many reasons, including easing parent fears by showing you are going slowly and evaluating the implementation carefully. A follow-up meeting can then be held, revealing results from the pilot and examining plans for future use.

Considerations

- Holding parent meetings
- Soliciting parent feedback
- Providing hands-on interaction with mobile devices
- Informing parents through letters, e-mails and Web updates
- Starting out with a pilot program

10. CHALLENGES — FINDING FUNDS AND EQUAL ACCESS

Affording Technology Upgrades

This is one of the toughest challenges for many schools considering BYOD. While adding or upgrading just the WiFi access can be reasonably affordable, a holistic bandwidth improvement campus-wide can come with a big ticket (such as Forsyth County Schools' $1.4 million wireless network upgrade).

Keep in mind that using digital learning can free up funds that otherwise would be spent on expensive print textbooks. (Studies show K-12 districts can save more than $3,000 each year in a single classroom by converting to mobile devices.)[39] Allowing students to bring their own devices means districts can spend less in devices purchased for students (as in one-to-one programs).

Funding alternatives include:

- ***E-Rate:*** This federal program provides discounts of 20 to 90 percent on telecommunications services and Internet access on a sliding scale, based on the number of students in free and reduced lunch programs
- ***Grants:*** Either from the government, nonprofit foundations or other organizations
- ***Consortiums or cooperatives:*** Join forces with other districts or entities (including colleges and local government) to buy needed equipment and services
- ***Leasing equipment and services***
- ***Outsourcing:*** Let others manage aspects of your IT; cloud technology options may exist

Ensuring Equity

What about students who don't have their own devices? While some students may have the means to bring in a shiny new mobile device and

also the ability to connect online at home, other students may have neither a device or data plan. A survey of more than 100,000 people across the U.S. by the Census Bureau in October 2010 found about 32 percent had no high-speed access to the Internet and almost a quarter had no computer in the home. There are even wider disparities by age, income, education, race and location (rural vs. urban).[40]

There are several ways to address any potential digital divide within your district.

- Providing devices for those who don't have their own to be used on-site, but returned at the end of the school day.
- Providing devices for 24/7 use that can be checked out for a school year, a semester or other term. (Parents may be asked to buy inexpensive insurance policies in case of loss or theft.)
- Not providing devices, but making sure teachers don't require them; if devices are needed during class, make sure assignments are designed so that "haves" can share with "have nots" (for example, using them during group projects). Also, ensure students have access to tech resources (such as classroom desktops), which are more likely to be available if most students are using their own technology.
- Not providing devices but offering low-cost alternatives to parents through arrangements with private vendors. For example, Comcast has a national Internet Essentials plan for children who qualify for free and reduced lunch, offering low-cost Internet for $9.95 per month, plus netbooks for as low as $150.

Brebeuf Jesuit Preparatory School is trying out BYOT on a voluntary basis and is considering moving to a mandatory BYOT policy — but first will ensure all students have equity of access, says LaMaster. "We will not move forward until we can ensure all students would have equal access to the device of their choice." The school is examining financial aid options to help students buy mobile devices.

For now, Brebeuf has a voluntary program and lets students who don't have their own devices check out e-book readers and notebooks, with hopes of adding tablets in the near future. Forysth provides wireless notebooks for students who don't bring their own devices.

Considerations

- How many students might need devices if you adopt a BYOD program?
- Can you afford to purchase mobile devices for them to take home?
- What other type of device alternatives exist for students who can't afford their own?

From Planning through Installation

- First, set your goals. How will BYOD achieve them?
- Visit other school districts to see how they are implementing and what they've learned.
- Assess infrastructure to see if/when it could handle increase in load that can be expected from BYOD. Are there funds to do this?
- Survey to find out how many students have devices and what they are.
- Let parents and rest of community know you are exploring this possibility and seek feedback.
- Have meeting to discuss parent concerns, rules for using; explain benefits observed in other districts.
- Have students bring in devices. Test to see how they connect. Get feedback from students and teachers.
- Set up training sessions for teachers: block out time away from class with coaches or other experts.
- Set up regular collaboration time/ professional learning communities with teacher leaders (tech-savvy early adopters) as coaches and tech mentors.
- Give BYOD a start with a pilot program: either just one class or perhaps one grade level, or several classes at different levels in the district.
- Have students who are participating sign acceptable use policies/ BYOD agreement.
- If school is providing them, make devices available to students who do not have their own.
- Keep parents regularly informed through teacher wiki, e-mails home or a school newsletter. Keep lines of communication open.
- Teachers will be adapting lessons to use with new technology, as well as trying new activities not possible without mobile devices.
- Evaluate results to determine load on infrastructure, connectivity and other issues. Consider broadening BYOD to the entire school.
- Have another parent meeting to discuss any remaining concerns.

Conclusion

As mobile technology continues to become pervasive in everyday lives and in the working world, its incorporation in education is inevitable. The question becomes how best to provide access for students.

Districts that are able to provide devices, such as laptops, to students may find that no one single tool suits every task. Those students who own mobile devices already may find it easier to use the tools with which they are most familiar and comfortable.

Bailey Mitchell, chief technology and information officer at Forsyth County Schools, says districts that ban mobile devices will not be able to sustain such policies for long.

"Understand that it's coming regardless of what we can now support or even think should happen," says Mitchell. "Most students in the near future will have computing devices with them and using them. To access the Internet and other data will just be part of their daily lives. We won't be able to continue to control or ban students from having cell phones, computers, etc. — and shouldn't."

RESOURCES

Forsyth County Schools BYOT Resources
http://www.forsyth.k12.ga.us/site/Default.aspx?PageID=825

Consortium for School Networking — "Leadership for Mobile Learning"
http://www.cosn.org/Initiatives/LeadershipforMobileLearning/tabid/8108/Default.aspx

"Bring Your Own Device Catching on in Schools"
http://www.eschoolnews.com/2011/04/29/bring-your-own-device-catching-on-in-schools/

"BYOD, Bring Your Own Digital Devices: The Next Wave in 1:1 Laptop Learning in Our Schools?"
http://21k12blog.net/2011/10/04/byod-bring-your-own-digital-devices-the-next-wave-in-11-laptop-learning-in-our-schools/

ENDNOTES

1 http://blog.nielsen.com/nielsenwire/social/

2 http://blog.nielsen.com/nielsenwire/online_mobile/generation-app-62-of-mobile-users-25-34-own-smartphones/

3 http://www.journalism.org/analysis_report/tablet?src=prc-headline

4 http://www.morganstanley.com/views/perspectives/tablets_demand.pdf

5 CDE interview with Bailey Mitchell, Oct. 17, 2011

6 http://triblocal.com/hinsdale/2011/10/06/hinsdale-central-loosens-use-of-cell-phones-during-school/

7 "High Tech Cheating," Common Sense Media/Benenson Strategy Group, 2009

8 www.tomorrow.org/speakup/pdfs/SU10_3EofEducation_Students.pdf

9 CDE interview with Bailey Mitchell, Oct. 17, 2011

10 http://www.tomorrow.org/speakup/pdfs/SU10_3EofEducation_Students.pdf

11 http://www.google.com/trends?q=BYOD,+BYOT

12 http://www.cio.com/white-paper/690958/Aberdeen_Research_Brief_Prepare_Your_WLAN_for_the_BYOD_Invasion

13 http://www.itproportal.com/2011/11/01/ibm-allows-employees-personal-smartphone-devices-workplace-tasks/?

14 http://blogs.federaltimes.com/federal-times-blog/2011/03/24/nasa-ctos-open-to-bring-your-own-device/

15 http://www.enterprisecioforum.com/en/blogs/judy-redman/new-federal-cio-vows-continue-kundra%E2%80%99s-cloud-computing-strategy

16 CDE interview with Lenny Schad, Sept. 16 2011

17 http://www.mdrc.org/publications/419/full.pdf

18 Kirsch, et al, 2002

19 National Research Council, 2000 and 2003

20 http://www.tomorrow.org/docs/Project_K-Nect_EvaluationReport_Final_Jul7.pdf

21 CDE interview with Kyle Menchhofer, Oct. 19, 2011

22 CDE interview with Bailey Mitchell, Oct. 17, 2011

23 http://www.simbainformation.com/Going-Mobile-PreK-6055405/

24 http://www.nytimes.com/2011/01/05/education/05tablets.html?pagewanted=all

25 CDE interview with Charles Thacker, Oct. 14, 2011

26 CDE interview with Kyle Menchhofer, Oct. 19, 2011

27 http://www.convergemag.com/infrastructure/Wolf-Creek-Public-Schools-BYOD.html

28 CDE interview with Bailey Mitchell, Oct. 17, 2011

29 CDE e-mail interview with Jennifer LaMaster at Brebeuf Jesuit Preparatory School, Nov. 11, 2011 and Nov. 13, 2011

30 http://blog.lightspeedsystems.com/products/2011/11/09/byod-or-school-supplied-webinar-follow-up/ and http://www.cde.ca.gov/eo/ce/wc/)

31 http://www.fcc.gov/guides/childrens-internet-protection-act

32 http://www2.ed.gov/policy/gen/guid/fpco/ferpa/index.html

33 http://www.coppa.org/coppa.htm

34 http://www.schooltube.com/video/42a81cfd2bf60d9a852b/BYOT-Legal-Perspective

[35] See agreement here: www.forsythcountyschools.org/.../Draft_BYOTAgreement_SES.pdf

[36] http://www.convergemag.com/infrastructure/Wolf-Creek-Public-Schools-BYOD.html

[37] CDE interview with Bailey Mitchell, Oct. 17, 2011

[38] http://www.convergemag.com/infrastructure/Wolf-Creek-Public-Schools-BYOD.html

[39] http://www.simbainformation.com/Going-Mobile-PreK-6055405/

[40] http://www.ntia.doc.gov/report/2011/exploring-digital-nation-computer-and-internet-use-home

ACKNOWLEDGEMENTS:

John Halpin

John Halpin is Vice President of Education Strategic Programs for the Center for Digital Education. As a veteran K-12 teacher, college professor and IT consultant, Halpin has been active in promoting the use of technology in education for over 25 years. He has led sales and marketing efforts for some of the largest technology companies and has written for various media outlets. In addition, Halpin is a frequent speaker on public sector technology issues for national professional associations, various state leadership councils and technology companies.

Lorna Collier

Lorna Collier has written about education and technology for the Chicago Tribune, THE Journal, Learning Solutions, the National Council of Teachers of English Chronicle, MSN Encarta, ATT.net, and many others. She is the former online editor for GetEducated.com, a website focused on distance learning.

Meru's virtualized wireless LAN enables schools to deliver voice, data, video, and multimedia applications with high reliability and performance—regardless of the type or number of devices connected. Schools can keep students, teachers, and administrators continuously connected in the classroom, across campus, and between schools. The students learning experience is enhanced with laptop carts and 1:1 computing programs, access rich multimedia content, online books, and virtual tours to another part of the world. Easy to deploy and simple to manage, schools are able to deliver an incomparable user experience and a lower total cost of ownership than other wireless LANs. For more information about Meru in K-12, please visit **www.merunetworks.com.**

Education. Innovated.

At Samsung we create groundbreaking solutions that empower educators and students to embrace tomorrow's opportunities today. Our innovative offerings add value to any curriculum by giving instructors the tools they need to engage students, inspire imaginations, elevate learning and bring lesson plans to life.

To begin preparing your school for a brighter future, visit **www.samsung.com/education**.

For additional copies or to download
this document, please visit:
www.convergemag.com/BYOD-handbook