



Tablets in the Classroom

A Practical Guide to Planning and Deploying Large-Scale Tablet Initiatives



Produced by **CENTER FOR DIGITAL EDUCATION**



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Introduction: The Rise of Tablet Deployments in K-12

Flexible, portable and affordable, the tablet is becoming the device of choice for school-purchased 1:1 programs. More than a third of end-user devices shipped to U.S. education institutions in 2012 were tablets — double the number shipped in 2011.¹ In a recent Center for Digital Education (CDE) survey on 1:1 computing and education technology, IT leaders in K-12 education chose the tablet as the most beneficial device for all grade levels, except grades 9 through 12 (tablets still came in second after laptops).

Educators and administrators choose tablets because of the possibility of new teaching and learning models driven by ease of use and the ability to customize the learning experience. In addition, tablet-based 1:1

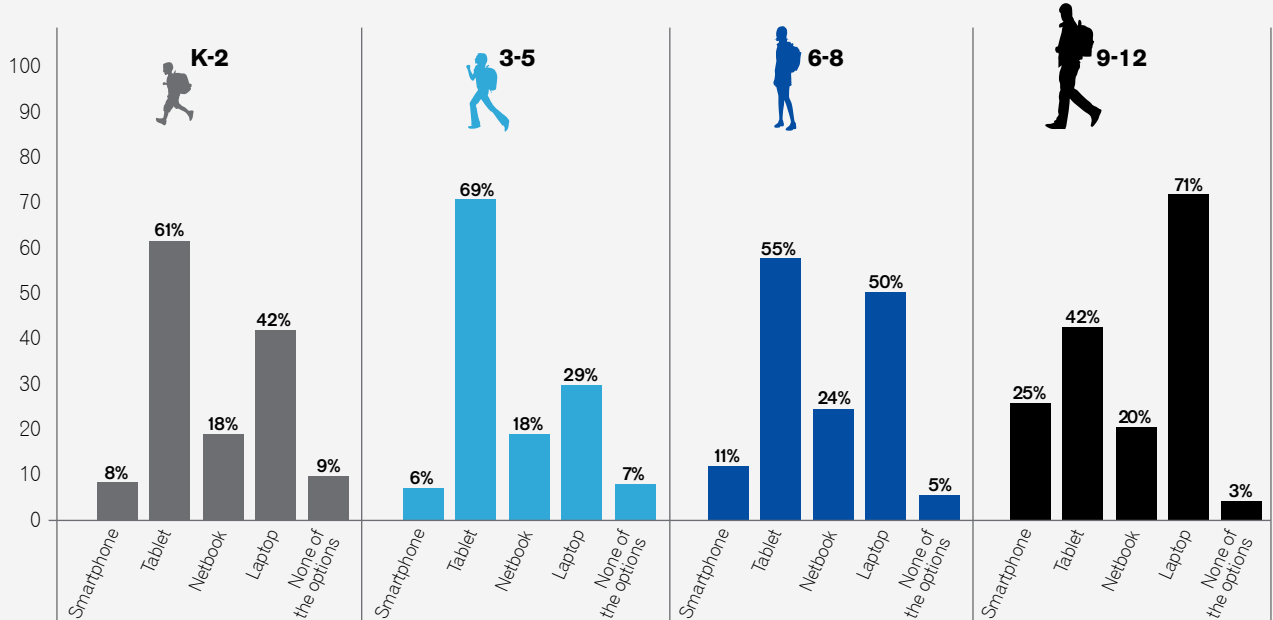
solutions provide both on- and off-campus access to online or cloud-based digital learning resources required by the Common Core State Standards (CCSS) and other technology-focused curricula.

Launching a large-scale tablet initiative will likely be any district's most significant technology implementation for years to come. This handbook will help you develop a plan and strategy for tablet deployment.

Based on in-depth interviews with district administrators and technology leaders, CDE has compiled best practices for planning and managing large-scale 1:1 tablet deployments. Education leaders will find useful checklists, questions and suggestions to assess technology infrastructure, evaluate hardware and software, deploy and manage tablets, coordinate professional development, measure results, develop a budget and find funding. We hope this guide serves as a useful tool for bringing 1:1 tablet-based learning to your district.

More than a third of end-user devices shipped to U.S. education institutions in 2012 were tablets — double the number shipped in 2011.

WHICH DEVICE IS MOST BENEFICIAL FOR EACH GRADE LEVEL?



SOURCE: CDE SURVEY 2013

Planning and Strategy

The IT leaders we spoke with could not emphasize the importance of planning enough. “You have to plan ahead and be visionary,” says Dr. Laurel Ashlock, assistant superintendent and chief academic officer at Central Unified School District in Fresno, Calif. “Give yourself plenty of time to get all the pieces in place and create an integrated system.”²

In this stage, assess readiness at the district and individual school level and develop goals, objectives, programs and timelines. The checklist below is a starting point.

Assess culture and capabilities. Examining existing culture and capabilities provides a clear understanding of your district and schools’ strengths, weaknesses, opportunities and threats, making it easier to determine the steps needed to achieve goals. Across the district and at individual schools, evaluate:

- Success of comparable technology initiatives
- School policies, e.g., mobile device, acceptable use, Internet filtering
- Student, parent and community demographics
- Level of support across various stakeholder groups

Develop goals and objectives. In terms of teaching and learning, what do you want to achieve? Depending on district needs, examples might include:

- Enhance quality of learning with online resources and tools
- Prepare students for higher education and workforce by increasing digital literacy
- Ensure all students have access to technology tools at home
- Improve special education with engaging technology
- Increase scores on standardized tests
- Institute more individualized, self-directed learning with equal or fewer teaching resources
- Create a student-centered classroom environment

Assess technology infrastructure. A thorough evaluation of networking, computing and storage resources is needed. It’s not suggested that you “rip and replace” infrastructure; however, as you assess aging infrastructure in the context of a tablet initiative, you may consider near- and long-term upgrades to technology platforms that will support a seamless, efficient learning process.



- **Network**

- The district Internet connection, enterprise wide area networks (WANs), local area networks (LANs) and wireless LANs (WLANs) should be sufficient to handle a sudden, simultaneous load of thousands of mobile devices. (Later on, we provide greater detail on ensuring district and school networks are “up to speed.”)

- **Computing**

- Server hardware and architecture should be reliable, highly secure and scalable to provide smooth access to network resources and applications.
- As your older equipment ages out, consider a virtualized or cloud-based environment. Either model has numerous benefits that help reduce costs and improve efficiency.

- **Storage**

- Storage requirements — for servers, data warehousing, end-user data storage and sharing, and backup/disaster recovery — will increase as learning moves online.
- Storage can also be virtualized or moved to the cloud for increased cost savings and efficiencies.

Create programs and timelines. Goals and objectives drive the development of individual programs. Examples are:

- Launch a pilot initiative in each middle school
- Roll out tablets to sixth graders in all Title I schools
- Provide a tablet for all district teachers

Once you’re clear on specific programs, corresponding activities, action items and timelines will fall into place.



SNAPSHOT: CENTRAL UNIFIED SCHOOL DISTRICT

Location: Fresno County, Calif.

Student Population: About 15,000

Number of Schools: 21

Type of Initiative: District-provided tablets for all students and teachers

District-Purchased Hardware: 16,500 Android™ tablets

Deployment Status: In process; to be completed in 2014-2015 school year

To provide students with a more engaging, individualized learning experience, Central Unified is transitioning from traditional textbooks and working with a publisher to develop customized, interactive learning materials that will adapt to students' learning levels and abilities. To support the new learning program, the district plans to roll out tablets to all of its 15,000 students in fall 2014.

This year, each of the district's 900 teachers received a tablet, according to Assistant Superintendent and Chief Academic Officer Dr. Laurel Ashlock. "We didn't want to just start handing out tablets to students without preparing our teachers," she says. "We're giving them a year to get comfortable and experiment with integrating the tablet into their teaching activities before rolling the tablets out to the students."

The tablets, which have WiFi® and 3G/4G Internet capabilities, will help extend learning beyond the classroom for students that don't have Internet access at home. "Between 30 and 40 percent of our students don't have Internet at home, and more than 70 percent are socioeconomically disadvantaged. Plus we're a very rural district where many areas don't have cable or DSL broadband access," explains Ashlock. "We're working with a carrier that's providing a pooled 3G/4G data plan to allow students to access the mobile network at home."

E-Rate and other federal grants will cover 81 percent of the \$2 million cost of the technology initiative, which included upgrading to a faster Ethernet-based fiber network, expanding network capacity at individual schools and updating the district's operating center.

Upgrading Network Infrastructure

"Network infrastructure is the foundation for ensuring that our students receive useable and secure resources," says Pat Karr, director of network services and support at McAllen Independent School District in Texas. "Without sufficient bandwidth, students and teachers will experience network interruptions that waste time and cause frustration."³

Networks must be able to handle:

- Higher traffic, including an overall increase in device/user density on a regular basis
- New traffic patterns
- Traffic spikes, such as during online testing
- An increase in downloading and uploading of high-bandwidth content that requires high latency

"Network infrastructure is the foundation for ensuring that our students receive useable and secure resources. Without sufficient bandwidth, students and teachers will experience network interruptions that waste time and cause frustration."

Pat Karr, Director of Network Services and Support, McAllen Independent School District

A recent survey of 450 K-12 districts undertaken by the Consortium for School Networking (CoSN) suggests the majority of districts are lacking needed network performance. Ninety-nine percent of the districts surveyed said they need higher Internet bandwidth within three years.⁴ And 47 percent of IT leaders in the CDE survey previously mentioned said their WAN lacks the capacity to serve students and staff.

Determine peak bandwidth needs (the amount of bandwidth required to meet maximum levels of simultaneous student access) and measure current performance and connectivity levels. If your analysis suggests the district does not have sufficient performance to support a 1:1 tablet initiative, there are a couple of options.

UPGRADE EXISTING NETWORKS

Many districts are heavily invested in external Internet connections with WANs for internal connectivity, so they

have pervasive WLAN coverage (access points deployed throughout each campus). If this is the case — and if sufficient funding is available to cover the (capital) cost — then a good option is to upgrade external Internet connections, WANs and WLANs as needed.

For external Internet and WAN connection upgrades, consider the following recommendations from the State Educational Technology Directors Association (SETDA):

- External Internet connection to the Internet service provider (ISP) of at least 100 Mbps per 1,000 students/staff for 2014-15
- External Internet connection to the ISP of at least 1 Gbps per 1,000 students/staff by 2017-18
- Internal WAN connections of at least 1 Gbps per 1,000 students/staff for 2014-15
- Internal WAN connections of at least 10 Gbps per 1,000 students/staff by 2017-18⁵

In addition to boosting network capacity, build redundancy and resiliency into district and school networks to help ensure that network access is never interrupted.

When upgrading WLANs, keep in mind that the WLAN, a shared resource, was really never designed to support hundreds of devices — the more devices on the WLAN, the lower the share of bandwidth received by each device. You'll probably need more access points to make sure the entire campus is covered, including common areas.

And if you're using older WLAN technologies, consider an upgrade to at least 802.11n, the latest ratified version of the venerable 802.11 standard. Even though 802.11n is already several years old, it's still faster and more reliable than 802.11 a/b/g. The latest version of the standard, known as 802.11ac, is a great choice for networks facing the challenge of multiple mobile devices and users. However, even though many 802.11ac products are on the market, the final specification hasn't yet been ratified yet by standards-setter IEEE.

If you're upgrading WLANs, assess in-building or on-campus wired networks — they may need upgraded networking switches, server infrastructure or Ethernet cabling. Also, consider new tools for managing and monitoring your networks.

CONSIDER 4G/LTE CONNECTIVITY

The 4G/LTE mobile network is a viable alternative for network access, especially for schools and districts that

WLAN OR 4G/LTE? A COST COMPARISON

A cost comparison of network access solutions can be useful for schools and districts that are debating whether to upgrade existing Internet connections, WANs and WLANs, or simply use 4G/LTE networks for access. We've developed such a comparison as an example. This example isn't based on an actual deployment — schools and districts should complete their own independent analysis before deciding on an access technology.

The cost comparison is based on the following assumptions:

- 1,000 tablets are required for 1,000 students; 100 extra tablets (10 percent) to cover breakage, etc., for a total of 1,100 tablets
- WiFi tablet cost is approximately \$700/each
- LTE tablet cost, approximately \$200/each, is subsidized by the service provider based on a three-year contract
- WLAN access points to be refreshed after 5 years
- E-Rate subsidy is 80 percent
- Devices are used at school for only 30 percent of a billing month (9am to 4pm daily)
- Annual costs for WLAN maintenance and a full-time employee to manage the WLAN network increases two percent annually
- In-building LTE coverage is identical to WLAN coverage (i.e., LTE signal does not require augmentation)
- No change in LTE price over 10 years
- WLAN network requires 44 access points
- Cost of two redundant master WLAN controllers (one as a failover) is \$45,000 (one-time charge)
- The cost of the WLAN controller/access point/licenses is \$55,000 (one-time charge) and assumes the access points would need to be refreshed after 5 years
- Management platform cost is \$11,000 (one-time charge)
- Internal wiring cost is \$15,400 (one-time charge)

| WIFI NETWORK COSTS | YEAR 1 | YEAR 2 | YEAR 3 | YEAR 4 | YEAR 5 | YEAR 6 | YEAR 7 | YEAR 8 | YEAR 9 | YEAR 10 | TOTAL COST |
|-----------------------------------|----------------|---------------|---------------|----------------|---------------|----------------|----------------|---------------|---------------|---------------|------------------|
| One-Time WiFi Tablet Cost | 770,000 | - | - | 770,000 | - | - | 770,000 | - | - | - | 2,310,000 |
| One-Time WiFi Access Point Cost | 115,400 | - | - | - | - | 44,000 | - | - | - | - | 159,400 |
| Annual Maintenance/ License Costs | 4,195 | 4,279 | 4,364 | 4,452 | 4,541 | 4,632 | 4,724 | 4,819 | 4,915 | 5,013 | 45,934 |
| Annual FTE Labor Costs | 60,000 | 61,200 | 62,424 | 63,672 | 64,946 | 66,245 | 67,570 | 68,921 | 70,300 | 71,706 | 656,984 |
| TOTAL COST | 949,595 | 65,479 | 66,788 | 838,124 | 69,487 | 114,876 | 842,294 | 73,740 | 75,215 | 76,719 | 3,172,318 |

| CARRIER SOLUTION | YEAR 1 | YEAR 2 | YEAR 3 | YEAR 4 | YEAR 5 | YEAR 6 | YEAR 7 | YEAR 8 | YEAR 9 | YEAR 10 | TOTAL COST |
|--------------------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|------------------|
| One-Time LTE Tablet Cost | 220,000 | - | - | 220,000 | - | - | 220,000 | - | - | - | 660,000 |
| LTE Costs | 360,000 | 360,000 | 360,000 | 360,000 | 360,000 | 360,000 | 360,000 | 360,000 | 360,000 | 360,000 | 3,600,000 |
| E-Rate Subsidy | (86,400) | (86,400) | (86,400) | (86,400) | (86,400) | (86,400) | (86,400) | (86,400) | (86,400) | (86,400) | (864,000) |
| TOTAL COST | 493,600 | 273,600 | 273,600 | 493,600 | 273,600 | 273,600 | 493,600 | 273,600 | 273,600 | 273,600 | 3,396,000 |

haven't already made large investments in upgrading their external Internet connections, WANs and WLANs. For example, a school might be operating a T1-based asynchronous transfer mode (ATM) network and have only a few on-campus access points. In this case, upgrading all networks requires a significant capital expense, plus costs for network management, maintenance, staffing and ongoing upgrades to the network infrastructure.

E-Rate and other funding options (discussed later on in this handbook in greater detail) may be available, but if the cost is still out of reach, 4G/LTE networks can provide a predictable monthly charge.

4G is a family of mobile telecommunications protocols that delivers speeds up to 10 times faster than its predecessor, 3G. The major North American carriers use a type of 4G network known as LTE, which is deployed across the country and being built out to more markets over time.

In areas with 4G/LTE networks, schools can expect data download speeds of approximately 5 to 12 Mbps and upload speeds of approximately 2 to 5 Mbps. This means their performance and reliability rivals WLANs, especially those without pervasive coverage throughout campus. 4G/LTE mobile broadband access has an additional benefit: It provides Internet access to students whose families aren't able to afford or don't have access to the Internet at home.

Many mobile device management (MDM) applications work in tandem with mobile networks to provide proxy server functionality, which lets districts set up their proxy server to manage Internet use and filter content. Or the district can establish a virtual private network (VPN) as a private data channel to bring all network traffic back to the district to go out over its network and use existing content filters and security measures.

Look for a carrier that is willing to work with you to provide a predictable monthly bill without excessive overage charges or other penalties for exceeding data allowances. You can also work with carriers to improve 4G coverage in rural areas.

IMPROVE NETWORK SECURITY

The network must authenticate users, provide access to appropriate resources, help protect systems and data, and help block inappropriate content. Many advanced tools are available.

Firewalls. Besides protecting the school network from the public Internet, a good firewall helps provide students with a consistent Internet experience when using tablets

In areas with 4G/LTE networks, schools can expect data download speeds of approximately 5 to 12 Mbps and upload speeds of approximately 2 to 5 Mbps.

off site. It can also be used to filter content and monitor and report Internet usage. Firewalls can be hardware or software based, on premises or on the network.

Policy-based assignment is a network access technique that assigns users a certain level of access once their device is authenticated on the network. Policy can be based on identity, location, device, time of login, type of content being accessed or any other attribute. For example, non-school-provided devices could be excluded or provided with limited access to the network. Or you can provide students and staff with access to all resources from any device, while blocking guests. During online assessment, you might limit the use of video streaming not related to testing.

Virtual private networks (VPNs) provide highly secure access to the school network from anywhere. VPN software authenticates the user, protects the user session and allows students to "tunnel over" the Internet to access campus networks. Students can use VPNs to access library resources or even send print jobs to a campus printer, while teachers can access business and educational applications and data.

Virtual LANs (VLANs) look like separate networks but are really part of a single network that has been partitioned using software to create multiple distinct domains. You might create separate VLANs for students, guests, teachers and administrative staff. Or simply create a single VLAN for learning purposes and guest users. Network administrators can manage and configure all machines connected to the VLAN as an aggregate. In a properly configured VLAN, traffic that is part of one VLAN is not visible to another VLAN, which can greatly enhance security.

Content filtering. Content filtering includes email filters that scan incoming mail and data for viruses, spam, phishing, malware and inappropriate content; and Internet filtering that blocks malicious sites and objectionable content and websites. Configure the content filter to enforce your acceptable use policy (AUP) and provide auditable compliance to meet the requirements of the Children's Internet Protection Act (CIPA). Content filtering software can be purchased, configured and managed internally, or you can outsource the function to a service provider.

Evaluating and Integrating Tablets

Selecting a tablet for a 1:1 program requires a complex analysis of options. Choosing an operating system (OS) is one of the most important threshold decisions. The operating system will impact teacher and student acceptance, app availability, data sharing, learning workflow, and device management and support, to name a few.

As with any large investment, school district leaders will need to think about what their needs are and which features are most important to them before choosing an operating system. Some important considerations are:

- Cost of tablets using the OS
- Flexibility of the OS architecture and level of customization (if any) desired
- Security of the OS architecture and potential risk of malware or viruses
- Ability of the OS to integrate with other previously purchased district software
- Technical support and training available for the OS
- Student and teacher familiarity and level of comfort with the OS, as well as ease of use
- Apps available for the OS and cost of the desired apps
- The user experience when using the OS on covered devices

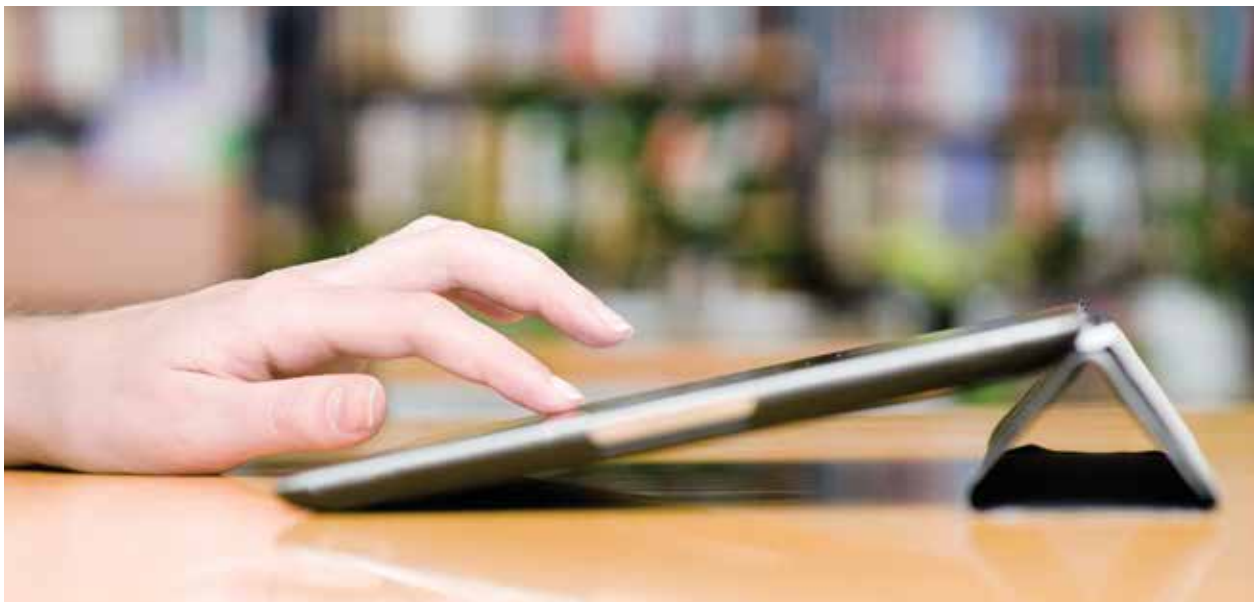
Each school district will likely value different features more highly than others. The important thing is to be aware of the various benefits of each operating system and

determine what works best for your teachers, students and IT staff.

BEYOND THE OPERATING SYSTEM

Besides the operating system, there are other important factors to take into account when selecting a tablet:

- **Hardware specs.** How long does the battery hold its charge? Are the memory and screen size appropriate?
- **Apps and app store.** Does the app store have the apps you want and need? Are there options for simultaneously syncing or downloading apps to more than one device?
- **Ease of support.** Some tablets may tax your support staff disproportionately. For example, IT staff with familiarity with a single operating system may need to restructure to adopt a second environment.
- **Hardware refresh.** Most consumer tablets have a two- or three-year life expectancy.⁶ Find the specific details for tablets you're considering and budget strategically.
- **Device security.** Depending on your needs, look for security features or options such as highly secure Bluetooth, passcode protect, autolock after a period of inactivity and autowipe after a certain number of failed passcode attempts.
- **Accessories.** If your tablets will require accessories such as keyboards, mice, monitors, etc., are they available and affordable? Will you need other accessories like projectors, interactive whiteboards, carts, charging stations and cases?



TABLETS AND COMMON CORE TESTING

SMARTER Balanced and the Partnership for Assessment of Readiness for College and Careers (PARCC), the two state-developed consortia charged with developing universal evaluation systems for Common Core curriculum, allow the use of tablets for testing, provided that certain minimum technology requirements are met.

To help schools prepare, both consortia have published technology standards for tablets and other computing devices to be used for testing.

| | PARCC ⁷ | SMARTER ⁸ |
|-------------------------|---|---|
| MEMORY | Depends on operating system; see below | Not specified for tablets |
| PROCESSOR | 1 GHz or faster | |
| HARD DRIVE | Not specified for tablets | |
| SCREEN SIZE | 9.5" or larger* | |
| SCREEN RESOLUTION | 1,024 X 768 or greater | |
| TABLET OPERATING SYSTEM | <ul style="list-style-type: none"> • Apple iOS 6 or newer on iPad 2 or newer, with at least 512 MB RAM • Android 4.0 or newer, with at least 1 GB RAM • Windows 8 or newer, with at least 1 GB RAM** | <ul style="list-style-type: none"> • Apple iOS 6 or newer on iPad 3 or newer • Android 4.0 or higher • Windows 8 or higher** |
| INPUT DEVICES | External wired, wireless or Bluetooth keyboard in addition to touchscreen or mouse | |
| SPEAKING AND LISTENING | Headphones or earbuds and microphone | |
| CONNECTIVITY | Must be able to connect to the Internet | |
| SECURITY | Must have the ability to be controlled via administrative tools to temporarily disable or control features and applications that could pose security problems during testing (e.g., Bluetooth, camera, etc.) | |

* Smaller-sized tablets and e-readers are not supported.

** At this writing, PARCC has not yet evaluated the Windows RT operating system; SMARTER has excluded it from its specifications.

INTEGRATING TABLETS INTO THE LEARNING ENVIRONMENT

How will students and teachers share and organize assignments and documents? Email is not a scalable solution. Some districts may opt to use the same learning platforms, applications and management resources across all schools; others may leave the choice up to the individual schools.

"The learning infrastructure must support 1:1 learning," says Jhone Ebert, chief innovation and productivity officer for Nevada's Clark County School District. "We have a learning management

system (LMS) that our teachers use to provide resources, content, assignments, tests and grades.

Students use it to securely submit work and communicate and collaborate with each other."⁹

If you already have an LMS to help students and teachers share and collaborate, make sure it's compatible with your tablets. If you don't have an LMS, consider investing in one. If you're not able to, many free or inexpensive cloud-based tools and apps enable collaboration and easy sharing of PDFs and other documents.

Don't buy or commit to any solution before you try it. This can be part of a pilot program.



SNAPSHOT: CLARK COUNTY SCHOOL DISTRICT (CCSD)

Location: Clark County, Nev., including the city of Las Vegas

Student Population: 315,000+

Number of Schools: 357

Type of Initiative: District-provided 1:1 tablets in nine schools, plus BYOD in rest of district

District-Purchased Hardware: 13,350 Apple iPads

Deployment Status: iPad deployment completed 2012-2013 school year

As the fifth largest school district in the country, CCSD can't realistically provide devices for all of its 315,000+ students, so it supplements a district-wide BYOD policy (CCSD Policy 5136) by providing iPads to approximately 11,225 students at nine Title I schools.

In 2011, the district experimented with iPads by implementing a four-school, 1,150-student pilot program that yielded much insight for the larger deployment, which took place in 2012 and 2013. CCSD had the tablets preconfigured and installed a district image and set of district apps, and had district-wide MDM on the back end.

"We determined the configurations and settings we wanted across the district. We thought that for professional development and support, it worked best to have consistency across schools," says Chief Innovation and Productivity Officer Jhone Ebert. "Through the pilot, we learned that even though consistency is good, we need to give the students as much flexibility and freedom as possible so they can personalize the device and put the apps they want on it. That way they have ownership and feel responsible for the device."

Because the majority of tablets were rolled out to low-income students, CCSD worked with community service providers to provide discounted Internet service to families of students in the program. Parents are encouraged to use the district's tablet as well. The tablets are installed with the ParentLink app, which allows parents to monitor their child's academic progress.

CCSD used general funds to finance the 2011 and Title I funds to finance the 2012 and 2013 initiatives.

Planning the Budget

"Funding is one the biggest challenges of a large tablet initiative," says Clark County's Ebert. "You have to be creative. We're one of the lowest-funded districts in the nation. If we can do it, anyone can do it!"

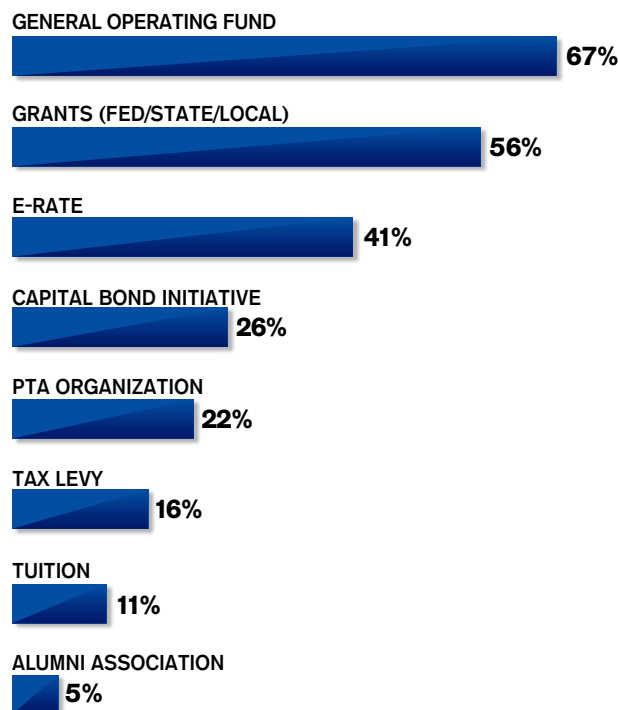
Like any technology project, a tablet initiative has many associated hard and soft costs that should be analyzed to determine the total cost of ownership (TCO) for the project: hardware expenses, accessories, warranties or service contracts, staff support, applications, management tools, infrastructure and technology upgrades, and professional development and training for teachers and IT staff.

The budgeting process should also include prioritization of technology programs and identification of areas for resource reallocation, productivity improvements and cost avoidance. Finally, prepare a comparative financial return on investment (ROI) — an estimate of potential benefits (i.e., student achievement, time-on-task, attendance, test scores and other measures of student success) for comparison with the cost of the proposed project. ROI calculations will be a blueprint for measuring the success of the project.

9 FUNDING SOURCES FOR TABLET INITIATIVES

- 1. E-Rate.** For upgrading aging external Internet connections, district WANs or enterprise wired and wireless LANs, the Federal Communication Commission's (FCC) E-Rate program is a valuable source of funding.
- 2. Other federal funds.** Educational organizations may qualify for other federal funding, such as Individuals with Disabilities Education Act (IDEA) grants to offset the costs of educating students with disabilities and Title I funding for schools and districts that serve a high percentage of low-income students.
- 3. Voter-approved local initiatives.** Voters may be positively inclined towards taxpayer-funded initiatives for technology procurement, such as municipal bonds, budget overrides or special-purpose local option sales taxes.
- 4. State funds.** Many states are providing supplementary funding for educational broadband. For example, the state of Florida's recently passed budget includes \$17 million for K-12 wireless access and broadband connectivity.¹⁰
- 5. Private sector.** Vendors, IT companies and local businesses may be willing to provide financial or other assistance.

WHAT FUNDING STREAMS DOES YOUR DISTRICT USE TO PROCURE NEW TECHNOLOGY?



SOURCE: CDE SURVEY, 2013

- 6. Cost controls.** Cloud-based and managed services are useful because they help you avoid large capital outlays.
- 7. Equipment leasing.** Consider leasing instead of buying tablets. At the end of a two- or three-year lease, the technology can be refreshed, which protects against rapidly evolving technology. This strategy provides relief for organizations with limited capital funds, because the cost of the lease is an operational expense that may be easier to include in an annual budget. And although leasing may increase TCO, this is often offset by the ongoing decrease in tablet costs. If needed, the vendor may be able to build the cost (and responsibility) of managing the tablets into the lease.
- 8. Grant funding.** Success depends on finding funding sources that are aligned with your district's location, specific grade levels or student socioeconomic status.
- 9. Loans.** Some states provide technology loans (for example, Illinois' School Technology Revolving Loan Program), and private loans from financial institutions are also an option.

BUDGET PLANNING WORKSHEET: TABLET INFRASTRUCTURE

This worksheet will help you estimate the cost of tablet-related technology investments related to large-scale tablet initiatives. (It does not include infrastructure upgrades, professional development or other training, support or staffing costs).

TABLET INFRASTRUCTURE/HARDWARE

| ITEM | QUANTITY | ESTIMATED COST/EACH | TOTAL |
|--|----------|---------------------|-------|
| Student devices | | | |
| Teacher devices | | | |
| Spare/loaner devices | | | |
| Device warranty or insurance | | | |
| External keyboards | | | |
| Headsets/earbuds | | | |
| Cases | | | |
| Additional hardware such as printers, mobile carts, laptop for mobile cart management, projectors, interactive white boards, etc., (list here) | | | |

MANAGEMENT APPLICATIONS AND LEARNING RESOURCES

| ITEM NAME/TITLE | QUANTITY/# OF LICENSES | ESTIMATED COST/EACH | TOTAL |
|--|------------------------|---------------------|-------|
| LMS (# of licenses/seats or total annual cost) | | | |
| MDM (# of licenses/seats or total annual cost) | | | |
| Additional apps, software, digital curriculum, online resources, etc., (list here) | | | |

Deploying and Managing Tablets

Many tools and services are available to centralize and automate the process of deploying and managing tablets, which include procuring and kitting, configuring settings, provisioning software, distributing to students, and maintaining and updating software and operating systems.

INITIAL DEPLOYMENT

The initial deployment includes tasks such as asset tagging, kitting and custom imaging. The tablets are removed from their retail packaging and assembled into “kits” as necessary — for example, adding a headset and case — and given an initial charge.

Each device is assigned to an end user. Barcoded asset tags are added to each component of the kit, associated with the device serial number and end user and scanned into a spreadsheet or database. If you’re using a mobile device management (MDM) platform for ongoing management, you’ll enroll each device. (We’ll cover this in greater detail in the next section.)

Security-related tasks include defining access privileges, creating user profiles, setting up user names and temporary passwords, configuring security settings and registering the devices on the school network. Alternatively, devices can be configured to allow students to self-enroll when they first connect the device to the network.

The initial process of kitting and provisioning devices can be quite time consuming. A cost-effective alternative is to contract a vendor, reseller or service provider to provide device provisioning as a managed service, which adds a few dollars to the cost of each device. “We used a third party for configuring the tablets because it was too much volume for our staff,” explains Clark County’s Ebert.

ONGOING DEVICE MANAGEMENT

Each major operating system has free or built-in management tools and apps that allow some level of remote management of multiple devices. Existing Windows or Apple management tools for other devices may be able to manage Windows and Apple tablets. Using a mobile tablet cart with a connected laptop, you can simultaneously sync, charge and perform other management tasks on multiple tablets.

However, if you’re dealing with thousands of devices, have multiple mobile operating systems (for example, a mix of laptops and tablets), or have a hybrid 1:1 strategy that

includes both school-issued and student-owned devices, then it may be more efficient to supplement free or built-in management tools with a third-party MDM solution that offers more advanced features and functionality and supports multiple operating systems. Plus, MDM software has many sophisticated security features that can play a critical role in mobility security.



HOW TO REDUCE THE RISK THAT STUDENT TABLETS WILL BE HACKED

If blaring headlines about student-hacked tablets are giving you sleepless nights, don’t worry — there are steps you can take to help protect against hacking. But it does require thoughtful preparation.

It’s important to keep in mind that in spite of their versatility, MDM software was originally developed for corporate environments where users are typically given more freedom to control their device — including the ability to unenroll their device from MDM software. In a recent high-profile incident, students overrode security controls simply by accessing their device setting panel and unenrolling from the district’s MDM.

While MDM can be used to deploy many configuration profiles, it’s probably wise to deploy the primary student profile through administrator-only-controlled tools (such as Apple Configurator or other Windows, Apple or Android management tools). This configuration helps prevent students from removing the MDM software.

Lesson learned: Plan carefully, do your homework and push your vendors to develop the most secure solution. And test, test and test some more before deployment.

SELECTING AN MDM PLATFORM

Select an MDM platform that's compatible with all relevant operating systems, devices, applications and service providers. Depending on your needs, budget and strategy, you may choose an on-premises solution, cloud-based service (software-as-a-service, or SaaS) or a managed service. The following cheat sheet can help you evaluate each option.

| MDM DELIVERY MODEL | DESCRIPTION | BENEFITS |
|--------------------|---|--|
| ON-PREMISES | <ul style="list-style-type: none"> • MDM servers installed on premises • Upfront investment is a capital expense (one-time fee for purchasing solution) • Solution is deployed, maintained and managed by school/district • School/district responsible for security of MDM servers/solution • Data stored on site or in school/district data center • Typically requires an annual maintenance fee for upgrades and support | <ul style="list-style-type: none"> • School/district selects hardware • School/district maintains high level of control over administration, security and data • High level of customization • Good solution for schools/district with available IT skills and resources |
| CLOUD-BASED (SAAS) | <ul style="list-style-type: none"> • MDM vendor hosts application remotely; application is accessed over the Internet in a highly secure fashion • Monthly or annual subscription; fee usually based on number of licenses • No capital expenses for hardware purchases • Support and maintenance, including automatic delivery of patches and upgrades, are provided by vendor | <ul style="list-style-type: none"> • No hardware or software to purchase or maintain • Unlimited scalability without additional hardware purchase • Fast implementation • Good solution for schools and districts with limited or stretched IT staff |
| MANAGED SERVICE | <ul style="list-style-type: none"> • Managed service providers aggregate and re-sell services from multiple vendors to provide bundled service offerings • MDM can often be bundled with pre-deployment services, including procurement, kitting and asset tracking • Recurring operational expense; usually a monthly lease based on number of licenses • Data can be stored on premises or by service provider • Support and maintenance, including automatic delivery of patches and upgrades, are provided by vendor | <ul style="list-style-type: none"> • No hardware or software to purchase or maintain • Access to a variety of vendor choices and best-of-breed solutions • High level of customization • Unlimited scalability without additional hardware purchase • Fast implementation • Good solution for schools and districts with limited or stretched IT staff |

MDM applications allow for remote management of large groups of devices, multiple groups of devices based on profile (for example, students and teachers) or a single specific device. MDM apps can be configured to remotely (wirelessly) complete many tasks from a central management console, including:

- Configuration of email, WLAN and VPN capabilities
- Data protection on lost/stolen devices, including device lock, wipe, encryption and password recovery

- Management of required or prohibited applications and content, including whitelist and blacklist applications/content
- Content and application distribution, including pushing out apps, resources and upgrades
- Provisioning custom images
- Configuring and updating settings
- Monitoring compliance with guidelines
- Synchronizing files

Implementing Professional Development and Training

A tablet initiative should involve extensive professional development and training for teachers and IT/support staff.

TEACHERS

Professional development for teachers can make or break a tablet initiative. Begin by assessing teacher readiness and technology expertise. What are the current levels of educator technology expertise, and what levels of expertise are needed? Don't just guess about this — many tools are available to help you evaluate teacher readiness to integrate new technologies and pedagogies. This will serve as the foundation for your professional development efforts.

Involve teachers in the planning process. Work with them to:

- Get feedback and develop goals
- Understand professional development requirements
- Create roles and responsibilities
- Develop and test pilot initiatives
- Create a sense of initiative ownership and pride

Create a small team of teachers with interest and enthusiasm for technology, provide them with appropriate professional development and use their classrooms to launch pilot programs. Work with this group to integrate tablet-based learning, fine-tune the program and smooth out rough spots before launching it to larger groups. This "advance guard" can help evangelize the benefits of tablets and even train other teachers.

Provide teachers with a variety of opportunities and methods to develop competencies, learn how to integrate tablets into the classroom environment, and collaborate and share with other teachers. Give teachers tablets well in advance of a student deployment, and work with them to integrate the tablet into the learning environment. Ideally they should have several months of practice in a classroom environment.

Alabama's Auburn City School District, an early adopter of 1:1 technology, continues to improve and evolve its 1:1 initiative, which was initially launched in 2006. Currently, the district provides its 1,300 high school students with tablets equipped with detachable keyboards that allow them to double as laptops.

Teacher professional development has always been a critical part of the initiative, according to Technology Director Debbie Rice. "When a teacher says 'I need more of this,' we listen closely," explains Rice. "Our PD

is modeled on that input. We're constantly changing because we look at teachers' needs while doing what works best for the classroom."¹¹

At the beginning of the program, teachers received a full year of professional development before the initiative was launched. Rice says that as much of the training as possible is internal to keep costs low. Now, new teachers receive a week of technology training at the beginning of each school year, and they meet monthly with a mentor who provides ongoing training. Each school employs a full-time instructional technology coach, and each year all teachers attend multiple meetings where they share teaching approaches and tips on technology use.

"Children can pick up a device and move forward," says Rice. "Teachers pick up a device and ask the question, 'How can I make sure 25 or 30 students are focused and on task with this device?' You have to make PD a priority for the sake of your teaching staff. Teachers have to be given time to adapt to the changes technology brings to the classroom."





SNAPSHOT: MCALLEN INDEPENDENT SCHOOL DISTRICT (ISD)

Location: McAllen, Texas

Student Population: About 25,000

Number of Schools: 34

Type of Initiative: District-provided tablets for all students

District-Purchased Hardware: 25,000 Apple iPads and the iPod Touch®

Deployment Status: Completed during 2012-2013 school year

McAllen ISD was one of the earliest schools to adopt a 1:1 tablet initiative. To support the success of its Transforming Learning in the Classroom, Campus and Community (TLC3) teaching and learning framework, the district wanted to place a mobile device in the hands of every student. Students from the 1st through 12th grade received iPads, while students in Pre-K and kindergarten received the iPod Touch.

Director for Network Services and Support Pat Karr says the district's demographics — 67 percent of its students are economically disadvantaged — factored heavily into its decision to provide tablets for each student. "We don't prohibit BYOD, but as a means for enabling tablet-based learning, it would be out of the question not to provide an option to allow a student or staff member to bring their own device to school," he notes. "Most families within our demographics could never afford to purchase devices for their children."

At the district data center, McAllen ISD is connected to the Internet with two redundant 10 Gbps Ethernet connections for load balancing (and the capacity to go to 20 Gbps), and 1 Gbps to each school. With the help of E-Rate funds, the schools' individual enterprise networks and WLANs were upgraded in preparation for TLC3. "The infrastructure wasn't in jeopardy, but the upgrades gave us the confidence that we could push content over the Ethernet network more efficiently," says Karr. "During the last week of school in the spring, the kids were really pushing the Internet and we felt really good about what we had in place."

Besides E-Rate, the district relied on other local, state and federal funding for the various components of the \$20 million TLC3 initiative.

TECHNOLOGY STAFF

With proper planning, an influx of any mobile student device should not excessively strain district and school IT infrastructure and staff. In the planning and strategy phase, the analysis of your existing network, technology infrastructure and other IT resources will be the foundation for smooth, efficient teaching and learning, and for preparing and training IT staff to troubleshoot any issues that do occur.

As you prepare to launch a tablet initiative:

- Don't neglect professional development/training on new equipment for technology staff
- Develop online support documentation and resources for students, teachers and parents
- Ensure that appropriate budget is available for vendor service contracts
- Provide tech leads to work with teachers on technology integrations, basic troubleshooting and end-user support
- Create detailed support plans and make sure every teacher knows where to turn for tech support
- Consider purchasing extended warranties as a precaution against faulty devices
- Consider purchasing insurance for damaged, lost or stolen devices, or providing options for student insurance purchase
- Procure a stockpile of replacement devices to prevent learning from grinding to a halt due to a device problem

More service will be required to support the increase in district-owned devices, so you may need to restructure support services. Various levels of support may be available from your tablet vendor or a managed services provider.

If more staff is needed, high schools might consider student-staffed alternatives. Properly trained students can staff a help desk, serve as in-class media assistants or participate in an after-school repair technician program. You'll need to develop a selection and training process for this, however.

The analysis of your existing network, technology infrastructure and other IT resources will be the foundation for smooth, efficient teaching and learning, and for preparing and training IT staff to troubleshoot any issues that do occur.

Measuring Outcomes

Ongoing monitoring and measurement of the outcomes of tablet-based learning helps you fine-tune the initiative, evaluate its impact on learning and create a culture of sharing among key stakeholders.

Establish benchmarks. To establish benchmark measurements, document and evaluate existing instructional techniques, learning activities, student engagement and student achievement before deploying tablets so you can compare student performance in “before” and “after” scenarios. Areas to measure include attendance, student engagement, teacher and student feedback on the

learning experience, student outcomes, test scores, levels of independent learning and use of collaboration.

Implement monitoring. How will outcomes be measured? Determine how to continuously monitor progress and evaluate program outcomes.

Many excellent tools are available to help compile, analyze and present the immense amount of student data collected by online learning resources, as well as information about students' use of technology, mobile devices and network management tools.

TABLET INITIATIVE CHECKLIST

This checklist isn't a step-by-step process — many of these tasks can and should be completed simultaneously. View it as a resource to determine that you've completed the key tasks required for a successful tablet initiative.

Planning and Strategy

- ✓ Evaluate culture and capabilities across the district and at individual schools
- ✓ Develop goals and objectives
- ✓ Prioritize programs and timelines
- ✓ Assess technology infrastructure, including network, computing and storage resources

Evaluate Tablets and Tablet Infrastructure

- ✓ Research tablets/operating systems
- ✓ Evaluate MDM and other management/security tools
- ✓ Ensure learning, productivity and sharing apps (e.g., LMS)
- ✓ Grant access to learning content and other resources

Develop a Budget and Find Funding

- ✓ Estimate the cost of infrastructure upgrades
- ✓ Compare the cost of tablets that meet your needs
- ✓ Include hard and soft costs to determine TCO
- ✓ Prepare comparative ROI to help measure success

Prepare Students and Parents

- ✓ Prepare a communications strategy for students and parents
- ✓ Develop support materials/FAQs for students and parents
- ✓ Revise acceptable use policies if needed
- ✓ Educate on Internet safety and acceptable use
- ✓ Develop a student distribution strategy

Procure, Deploy and Integrate Technology

- ✓ Upgrade technology infrastructure as needed

- ✓ Procure tablets, MDM, LMS, apps, etc.
- ✓ Perform asset tagging and kitting
- ✓ Provision custom images
- ✓ Define access privileges
- ✓ Create user profiles and configure security settings such as user names, temporary passwords, lock PINs, etc.
- ✓ Enroll in MDM
- ✓ Register devices on the school/district network
- ✓ Integrate tablets into the learning environment (e.g., LMS)
- ✓ Distribute the tablets to students and/or their parents

Professional Development and Training

- ✓ Assess teacher readiness and technology expertise
- ✓ Engage teachers and involve them in the planning process
- ✓ Develop pilot programs with enthusiastic teachers who can help you fine tune the program and evangelize it to their peers
- ✓ Provide teachers with a variety of professional development opportunities
- ✓ Give teachers tablets to experiment with well in advance of a student deployment
- ✓ Boost IT staff if needed and don't neglect training
- ✓ Create detailed support plans
- ✓ Make sure every teacher knows where to turn for tech support
- ✓ Create online support materials for students, teachers and parents

Measure Outcomes

- ✓ Establish benchmark measurements
- ✓ Implement monitoring techniques
- ✓ Continuously monitor and evaluate program outcomes

Conclusion

Tablets have upended computing since the first modern iteration of the form factor was introduced in 2010. There's no way of knowing the tablet's long-term impact on K-12 education, but there's no question that they've taken the education market by storm. Not only are they eating away at the K-12 market share long held by more expensive PCs and laptops, they're making anytime, anywhere, personalized online learning a reality.

The huge potential gains delivered via 1:1 tablet-based learning require thoughtful planning and execution. We hope the guidance in this handbook gives you a head start on kicking off your tablet initiative, but it's a long-term and ongoing process that requires constant change and adaptation. "If you think that you deploy and then you're finished, you're sadly mistaken," says McAllen ISD's Karr. "The solution becomes a living environment that has to be taken care of. It will tell you when it is sick and when it is healthy. Don't neglect it, and don't be afraid to change it."

Reading this handbook is just the beginning of your school or district's exciting, ongoing and ever-changing journey towards tablet-based 1:1 learning.



ENDNOTES

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