

Tools for Teaching, Tools for Learning: A 1:1 Pilot Report and Recommendation

Technology is reshaping our world – the ways we work, how we create and consume information, and how we interact. In schools, skillful incorporation of technology into teaching and learning offers the possibility of more instructional choices for teachers and improved outcomes for students, particularly in the areas of collaboration, communication, and creativity.

A stumbling block that we sometimes meet when working to integrate technology in schools is that it is not always available. None of us, adult or student, are likely to invest fully in a tool that is not readily available or reliable. If our car was available 1 out of 4 days that we wanted to use it, we wouldn't make the most of the resource. If we needed to go to an internet cafe to use a computer or get online, we would not maximize its leverage in our life. Yet we often attempt to integrate technology by rolling a mobile cart of laptops into a classroom or by moving students out of their primary learning environment and into a computer lab.

I. Background & Rationale

In recent years, many districts and schools have begun exploring and adopting 1:1 computing models to address this and other issues. The movement first gained widespread notoriety in the last decade through a 1:1 laptop initiative in Maine, and through a number of local efforts in Iowa to adopt 1:1 computing. More recently, increasing numbers of local Massachusetts districts have adopted 1:1 computing at various grade levels, particularly with the advent of smaller, mobile devices that carry a lower cost.

In these programs, each student in a particular school or grade span is assigned a technology device such as a laptop or tablet. Devices are used by students to produce work, collaborate with others, and support workflow. Teachers in 1:1 models also use the same technology to support instruction and deliver content. As noted, the devices travel with the students between school and home.

Proponents speak enthusiastically about the possibilities for teaching and learning that exist in a 1:1 model; there are detractors and skeptics as well. In considering our own direction, we believed it prudent to conduct research, through both literature on the subject and by observing local school districts that have already adopted a program. Findings of both are detailed below.

II. Activities

During this fall and winter, a team visited nearby districts that have implemented 1:1 programs. That team included:

Michael O'Brien, Director of Technology
Todd Curtis, Assistant Superintendent
Donna Criswell, Instructional Technology Specialist
Maggie McGinty, PK-8 Mathematics Coordinator
Andrew Kuhn, Technician
Robert Armour, School Committee

We visited the following districts' 1:1 programs:

Shrewsbury Public Schools - iPads at grades 5 & 6
Millis Public Schools - iPads at grade 8
Burlington Public Schools - iPads at grades 9-12
Lincoln Public Schools (Hanscom) - iPads at grade 6; Chromebooks at grades 7 & 8
Wayland Public Schools - MacBooks at grades 9-12
Weston Public Schools - iPads at grades 7 & 8

In addition, the Sudbury Public Schools belong to several regional collaboratives, including ACCEPT and EDCO. Discussion of 1:1 implementations and best practices among the member school districts is a frequent agenda item for the monthly meetings at both the Curriculum and Technology levels.

III. What we Learned

a. Goals of a 1:1 Model

Perhaps in beginning to describe the goals or vision for a 1:1 model, it may be useful to dispel two common myths about 1:1 programs.

Myth 1: A 1:1 program will mean students will be using these devices each moment of the school day and for all of their outside class work. In fact, teachers will still need to make the best decisions about the most effective tools for a lesson or task.

Myth 2: A 1:1 program will reduce the reliance on teachers and make it possible to have larger class sizes. In fact, a 1:1 program allows for greater personalization of teaching and learning and unlocks greater potential for teachers to spend time with small groups and individuals, leveraging their expertise in our classrooms.

b. Benefits of a 1:1 Model

So what are the goals of a 1:1 technology program? The district has a stated goal of more effectively integrating "technology into instructional, operational, and administrative routines." This project

supports our exploration of the highest-leverage ways to support teaching and learning with enhanced technology.

More broadly, our overarching mission as a district is to continuously improve student learning outcomes. Our objective is to put a tool into the hands of students that will make their education more engaging, and that could positively transform the way teaching and learning takes place. The great potential is in a long range investment in terms of fostering a culture of student engagement in learning that mainly has long term quantitative--and qualitative--benefits. This pilot project will help us to evaluate how 1:1 technology allows us to do those things, especially as we collect data from the teachers, students, and parents involved.

Our investigation and our own experiences indicate the following potential benefits related to student learning, assessment, and implementation of new models such as the Common Core:

Personalized Learning / Differentiated Instruction. Recognizing that students do not learn the same material at the same pace and in the same way, 1:1 technology makes it possible for teachers to differentiate content delivery and student assignments, using a variety of teaching methods and tools. For example, videos can be paused and viewed multiple times by students for whom the traditional lecture moves too quickly. In addition to video, electronic and online resources can be selected and shared at the appropriate student readiness level or learning style, ensuring that the content is being delivered and standards are being met, in a way that can be best understood by all students.

Enhanced student engagement, motivation, and ownership for learning. In a 1:1 environment, the learning shifts from the more traditional instructor-led model to a more student-centered focus. Accessibility to online learning tools gives students choices and options that naturally engage them in the learning process. With effective differentiation and choices provided for learning and demonstrating understanding, student engagement and motivation increases.

Access to student work facilitates ongoing formative assessment. When students complete their written work and presentations through Google Drive and other web-based systems, teachers are able to view student work in-progress. This facilitates ongoing feedback to students from teachers and formative assessment opportunities; both of these are considered best practice in assessment and will lead to improved student outcomes.

Enhanced opportunities for group and project-based learning. In a 1:1 model, it is possible to shift from traditional 'lecture-based' learning, to more student-centered research projects and project-based learning. Not only does this model provide a variety of ways to deliver content, it offers a wider range of opportunities for students to show what they know and understand about a topic. Project-based learning is typically framed by a 'real-world problem' that requires students to work in groups, gather and synthesize information, think critically, and apply this knowledge. The teacher becomes a facilitator/coach helping to frame student questions,

scaffolding the tasks, and assessing what they are learning along the way. Project-based learning supports twenty-first century skills of critical thinking, collaboration, communication and creativity, critical skills required in the workplace. A student can choose from myriad technologies to implement effective research strategies, to collaborate with peers, and publish findings.

Enhanced opportunity for collaboration, within and outside the school and district. When provided with a device, students have a sense of ownership and are more apt to take charge and become more invested in their own learning. They have access to resources not confined by the classroom walls or the school day. Students are able to collaborate with their peers through tools like Google Docs, wikis, blogs, web 2.0 tools, etc., as they communicate and problem-solve. Personal devices will also enable students to access, manage, integrate, evaluate and create information in all their subject areas.

Access to primary source information. The Common Core standards envision students accessing primary sources of information from multiple sources in order to synthesize meaning and understanding - a key element of college and career success in the twenty-first century. On-demand access to a reliable device makes this possible for students and allows teachers in the classroom to plan around this instructional opportunity.

One-to-one technology improves student work flow. This was perhaps the most commonly cited finding across districts we visited. Students experienced greater independence, greater task completion, and more efficient workflow with the ability to electronically manage and share tasks in a single environment (as opposed to across multiple binders, notebooks, etc.) that travels easily between school and home.

Decreased emphasis on technology as a discrete topic or subject. A concern sometimes raised about 1:1 technology programs is that schooling will become overly-focused on technology and connecting students to devices. Ironically, making devices ubiquitous across the school day may actually have the benefit of *minimizing* technology as the focus of learning; instead of learning *about* technology, students learn *with* technology. Teachers are better able to use technology as it is literally intended, as a tool for achieving work and goals we already have, such as student learning, collaboration, access to information, and engagement in problem solving.

Minimization of traditional resources. While we would reiterate that the evidence in support of a 1:1 model is centered on student learning and not on cost-effectiveness, there are several elements related to efficiency that support the idea. With 1:1 technology, students require fewer resources such as binders, calculators, and *potentially*, some traditional textbooks. At minimum, it provides us the opportunity to fully explore and balance the benefits of digital resources versus traditional ones.

c. Evaluating Potential Devices

Should the district decide that it would like to support a 1:1 model, the next question would be one of the device. Before discussing that question specifically, there are two important general considerations involved:

Choosing a single device significantly enhances efficiencies in professional development, instruction, and infrastructure management. While many of the devices available perform similar functions, there is significant efficiency to be gained from adopting a single device for 1:1 programs. Professional development for educators and delivery of instruction can focus on a single platform and language. At the same time, management of the increased infrastructure, from permissions to hardware, becomes streamlined. This is particularly relevant in the early stages of adoption, when efficiency is key to successful implementation.

The specific type of device is not the most important consideration. While this may seem to contradict the previous point, and was a somewhat surprising finding during our visits, many districts made it clear that the actual device they used was much less important than the fact of going 1:1 at all. A focus on teaching and learning practices that came about as a result was more important than the device itself. The first 1:1 programs used laptops as the only choice available. Recently, the advent of the iPad made 1:1 programs more accessible through a lower price point. Now, the availability of other tablets and Chromebooks provide more choices that did not exist even two years ago.

We visited and spoke with districts that use full laptops, tablets, and web-based notebooks (Chromebooks) in their programs. Given that a full laptop carries an up-front cost of 2.5:1 and even 4:1 over other available options, we have not fully considered it as an option for Sudbury at this time.

The tables below, then, summarize the advantages and disadvantages of tablets versus web-based notebooks.

Chromebook Advantages	iPad Advantages
Price point allows for more devices quickly with lesser impact on rest of budget	Access to iWork suite provides the ability to create, edit, and publish from a single device (if students set up private Apple ID)
Quicker, more efficient adoption by teachers, since use of Google Apps fits existing schema for technology integration	Built-in camera allows instantaneous capture of content and facilitates organization
File sharing for collaborative work is easy	Supports text-to-speech, voice-over navigation, speech-to-text
Robust management tools for effective deployment, many of which we already have experience with as a Google Apps district	Greater mobility because of smaller size
Architecture for student accounts, access, etc. already exists through Google Apps for Education, and SPS creates and manages Google Accounts	For early elementary students, iPad lets non-readers instantly create – listen, watch, draw, record audio, take pictures, shoot video – all without needing to read; Tactile technologies ideal for young grade levels
Students can also access all their work from any computer by going to their Google account	
Existing Web 2.0 tools used by SPS tested and found to function nicely	
Screen and keyboard size are large enough for accessibility and multitasking	
Not tied to one OS (but see below for related disadvantage)	
High-use iPad districts reported that all of their "foundational" iPad apps are now web-based	

Chromebook Disadvantages	iPad Disadvantages
Not as mobile due to size and weight relative to tablets	Difficult to multitask, with keyboard covering half of screen area
Multiple devices needed for creating multimedia content (a camera, iPod, or iPad is required for digital images and video)	App management is cumbersome and time consuming, requiring greater technical support per device
Not equipped with 'touch' technology	Price point potentially narrows speed of and options for implementation funding
Not tied to an OS, but "applications" must be web-based	Would require that students create their own Apple IDs, or SPS creates them and limits what students can do.
	Persistent perception that the iPad is a inexpensive laptop, which leads to poor practices
	PD requirements would be much more intensive
	Many web-based tools do not display or function on iOS or are Flash-based
	Tied to one OS; only iOS apps can be used

d. Evaluating Grade Level Options

The districts we visited and the educators with whom we spoke have implemented 1:1 programs across the full spectrum of elementary, middle, and high school grades. For the Sudbury Public Schools, the choice in considering a pilot of a 1:1 model essentially comes down to which middle school grade level would be the most advantageous for that pilot. We believe that we will gain the most useful information from a pilot **at the 6th grade level**, for the following reasons:

- Sixth grade represents a natural time of transition between elementary and middle school, and would be a useful place to consider the need for additional supports provided by 1:1 technology.
- We believe that if the 1:1 device is able to be effectively integrated and used by our youngest middle school students, it follows logically that our other (older) middle school students would also be able to do so. We would have information from the pilot that would help us consider full adoption at other grade levels; we may not have the same level of confidence about generalizing downward through the grades.
- Having said that, a pilot with sixth grade students will also allow us something of a window into how our oldest elementary students would be able to work in this model.

IV. Implications of a 1:1 Model

Professional Development

Adoption of 1:1 devices would also require devoting resources to the support of teachers now using these devices as instructional tools in the classroom. Simply providing the hardware and infrastructure without deeper examination of the most effective and efficient ways to utilize them would not be an effective or responsible use of resources - for students, teachers, parents, or community members.

One vehicle for providing this professional development used by many districts we spoke with is discreet summer and/or weekend course work, typically provided by outside providers. While we typically emphasize internal expertise to lead professional development, this is one area, due especially to the newness of the work, that we believe outside assistance would be essential. Securing these providers and providing time for teachers would both represent a potential cost to the district. Even using significant amounts of in-district time such as ILAP represents some cost, in that those teachers would then not be available for other important PD work with colleagues.

The other significant vehicle for the provision of professional development to teachers and administrators would be support from in-district technology integration professionals. At this point, we have only one full-time technology integration specialist on staff. In a majority of the districts that we visited, there were multiple integration specialists, and 1 full-time professional per school was typical. Adoption of 1:1 at any scale would require the additional integration specialists to support teachers in the job-embedded, collaborative fashion that is best practice in any professional development endeavor.

Acceptable Use

A natural question that arises in reference to technology involves appropriate student use, particularly involving networked devices. While the district has an Acceptable Use policy already in place, implementation of a 1:1 program brings this question more to the fore. An important part of any 1:1 program is an emphasis on “digital citizenship” and clear communication both in school and between home and school about acceptable use of the technology so that students are doing so safely and appropriately.

It is also important to the district that students continue to access a wide range of learning opportunities and materials, that students are not “plugged in” continuously. An evaluation of this, including feedback from parents, will be an important part of our pilot program.

Funding

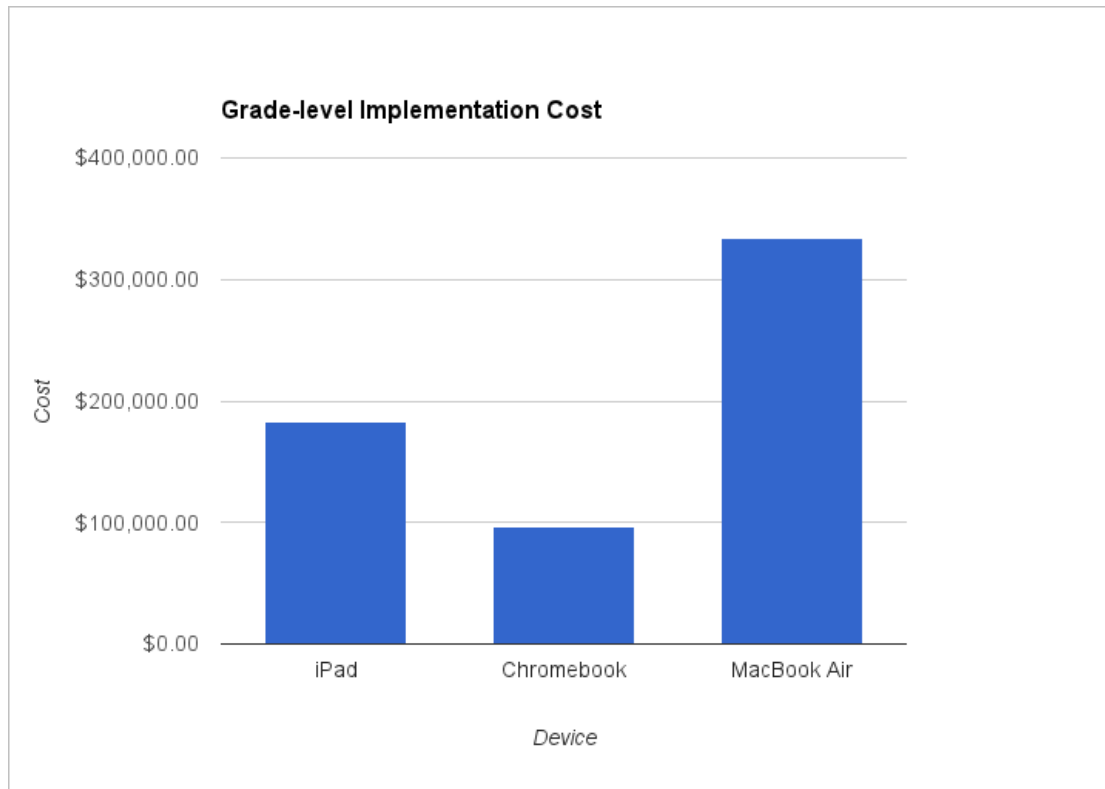
Ensuring that each student in a grade level or multiple grade levels has a 1:1 device impacts our resources significantly. This includes the cost of the devices themselves, network infrastructure updates, as well as human resources to support those networks and support professional development for teachers now using these devices. In the districts that we visited, these costs were addressed in a variety of ways, from full support through the annual appropriated budget, to one-time district funds (from

building projects, for example), to parent technology fees.

Given what we believe about the many areas of comparability between the available devices as far as positive impact on teaching and learning, adoption cost is a potentially significant factor in which device to pilot and adopt. Below, please find a table comparing the costs to pilot and adopt three devices - iPad, Chromebook and MacBook:

Device	Device Type	Unit Pricing	Pilot Size	Pilot Unit Cost	Pilot Cost	Grade Size	Grade Unit Cost	Grade Cost
iPad	Tablet	\$499	90	\$509	\$45,810	360	\$509	\$183,240
Chromebook	Laptop	\$249	90	\$275	\$24,750	360	\$269	\$96,840
MacBook Air	Laptop	\$949	90	\$929	\$83,610	360	\$929	\$334,440

The pilot and grade-level unit costs have been adjusted to include both price breaks from bulk purchasing and 3-years of device management.



In order for 1:1 devices to transform the way teaching and learning takes place in our classrooms, we need to invest in adequate technical support. Although devices deployed on a 1:1 basis might replace

some of the computers at the middle school, these would largely be adding to the 1200 computers already in place in Sudbury PK-8. A second technician position would provide a crucial piece of the support puzzle to make sure that teachers and students can focus on use of the technology and not troubleshooting.

V. Pilot Proposal

Based on all the factors described above, **we are recommending a pilot of Chromebooks on one sixth grade team during the 2013-14 school year.** In addition, we will purchase a cart of Chromebooks for mobile use by the 7th grade team at ECMS, which will allow us to gain information about their use in that fashion while we collect data on their effectiveness as personal devices.

The information gathered from our analysis of the devices and their resource implications points towards a 1:1 pilot with Chromebooks in Sudbury.

- As noted above, most districts with mature 1:1 programs described the specific device being less important than the fact of being in a 1:1 model at all.
- The Chromebook and iPad both appear to provide the capability to leverage collaboration, research and primary source access, create content and workflow improvement.
- The Chromebook, as seen in the table above, aligns more closely with our existing infrastructure and management tools.
- The Chromebook is more cost effective for initial hardware purposes and management resources required.

In order to maximize the potential for success and the ability to collect data that can be useful for future decision making, several elements of the pilot will require further examination, including:

- The pilot classes will require significant attention from our Technology Integration Specialist. Further expansion *beyond* a pilot will require additional technology integration staffing in order to adequately support those classes while also supporting the remaining schools and grade levels in SPS.
- As noted above, expansion beyond a pilot will also require additional technical support staffing. The use of Chromebooks instead of tablet or laptop devices will minimize this to some extent, but the department is already spread too thin even before we begin this project.
- Also as noted, additional professional development time will be required for pilot teachers. While the support of our integration specialist will provide a great deal of professional development, additional expertise and time will be required.
- We will need to provide parent training to the students in the pilot classrooms so that communication and implementation expectations are consistent between school and home, and to provide support and confidence to parents related to their students' use of 1:1 technology.

- While the pilot will explore free options for a learning management system (LMS) that provides course content organization for students, it will be important to evaluate whether these adequately meet our needs.
- Districts with 1:1 programs have partnered with parents in different ways to provide insurance coverage for damage to devices, since they travel between home and school each day. Options for this will need to be explored.