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Early Observations of High School Deployment of One-to-One Technology: A Qualitative Look at One-to-One Computing in Maine High Schools

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Background

All Maine 7th and 8th grade students and teachers received Apple laptop computers as part of the Maine Learning Technology Initiative (MLTI) in 2002 and 2003. In 2007, teachers in Maine's high schools were given MLTI laptops and in 2009, all high schools were offered the opportunity to participate in the MLTI program and provide their students with 1:1 computing.

Unlike the middle school program where the majority of expenses related to the program (devices, software, repairs, network infrastructure, technology support, professional development, etc.) are paid directly by the State, the high school option was to participate in the same program but the schools were required to forgo $242 of the $289 per student they receive annually from the State for technology. Many schools felt they were unable to re-allocate those funds and almost half of the high schools chose not to participate in MLTI. Some chose instead to purchase or lease less expensive devices (netbooks) and to manage their own program locally. Others chose not to deploy 1:1 devices at all.

Table 1: Maine High School 1:1 Deployment (2010)

	Fall 2010 number of grade 9-12 schools	Fall 2010 grade 9-12 student enrollment
MLTI 1:1 High Schools	62	23,090
Netbook or non-MLTI MacBook 1:1 Schools (Self-reported)	18	9,146
Non-1:1 High Schools	52	27,540
Total	132	59,776

As budgets have grown ever tighter during the past two years and as the Apple contract renewal date approaches, this research was developed to explore the experiences of high schools that have deployed 1:1 devices (both MacBooks and netbooks).

Purpose of this Study

This research compared the experiences of one-to-one deployment of a small group of MLTI high schools with those of a small group of netbook high schools in the following areas:

> General observations: What have been the benefits and challenges of launching a 1:1 program in high school? Has the type of device affected the experiences of schools (netbooks vs. MLTI MacBooks)?

> Usage of 1:1 Devices: How do the experiences of the students and teachers compare in the two different programs? Are the less expensive netbook devices adequate for use in the classroom? Does the level of technology integration vary by type of device deployed?

> Cost: Netbooks cost considerably less than MacBooks, but potentially come with additional costs for repair and replacement, software, etc.   This research will attempt to measure some of those costs.

At the time of the study, no high schools had deployed other 1:1 devices such as iPads, iTouches, or other internet-enabled tools. One school in Maine has introduced iPads in 2011-12, and will be studied as part of an ongoing effort to capture relative advantages of various potential learning technologies. Findings are not available at the time of reporting.

Methodology

CEPARE studied eight high schools across the state of Maine.   Data were collected from administrators, teachers, and students through interviews and focus groups conducted at each school, and from online surveys of teachers and students.

At each school, the principal and technology coordinator were interviewed individually. The configuration and role of the technology coordinator position varied from school to school. In some cases, a teacher was identified in the role, and fulfilled duties in addition to an existing teaching load. In other schools, a full-time staff member was dedicated solely to implementation of the 1:1 technology. In addition to these individuals, schools arranged interviews and/or group discussions with teachers. CEPARE requested that schools identify and invite teachers who were perceived as having a range of opinions and technology use patterns. Individual or small group discussions with students, selected based on their availability during a given time slot, were also conducted at seven of the eight schools. The number of interviews conducted at each school ranged from three to 11, with an average of eight interviews per school.

Due to the limited number of schools included in the study, the results should be considered exploratory.   While we interviewed over 60 individuals for this study, those individuals represent a small fraction of the administrators, technology coordinators, teacher leaders, teachers and students in Maine. The insights gained from our conversations provide glimpses into the experiences at different high schools but cannot be assumed to represent the majority of schools in Maine or even the experience of all

teachers in a particular school. A more extensive study is required to determine how the majority of schools are faring and to confirm or deny the observations from this work.

General Observations

Launching a 1:1 Program Requires Significant Staff Resources

The physical and administrative process of deploying a one to one program requires a significant amount of staff resources, especially from administration and technology staff, regardless of whether the computers are MacBooks or netbooks. There are physical requirements: imaging machines, tracking deployment of machines to students and setting up the process for dealing with repairs. There are also administrative requirements: developing a school-wide policy on appropriate use and consequences of misuse and determining how much of a "lock down" to place on the Internet, for example.   Developing and implementing these policies requires a lot of time and, depending on the staff available, can greatly impact the school's ability to maximize the time devices are in the hands of students. For example, some schools lose 25% of the school year because they lack sufficient staff to image devices and are unable to deploy devices to students until late fall. Several administrators compared the recent high school deployment of both MacBooks and netbooks to the early days of the middle school MLTI deployment – managing the details of the program and "working out the kinks" takes a significant amount of effort. Fortunately, the logistics of managing the devices in both netbook and MLTI high schools is perceived as improving each year.

It appeared from our interviews that the MLTI program roll-outs were somewhat smoother than the netbook roll-outs because MLTI high schools are able, to some extent, to expand processes already in place in their middle school MLTI programs. They do not have to re-invent the wheel, so to speak, and develop separate systems. MLTI schools also seemed to spend much less time up-front once they decided to participate in MLTI due to the comprehensive nature of the MLTI program. Schools that chose netbooks, on the other hand, had to research which device to purchase, determine which software, if any, to purchase, and had to negotiate contracts covering price, warranty and repair options.

Integration of technology into high school culture and classroom teaching is uneven. Most schools recognize they have a long way to go before they become fully integrated.

As seen in the middle schools we have studied since the inception of MLTI, there are large differences among high schools in the degree to which technology is integrated in classrooms. Some schools have a large proportion of teachers using computers in their teaching on a regular basis and are working toward developing ubiquitous online classrooms. In those schools, technology is becoming embedded into the school culture; as a result, students are motivated to bring their computers to school everyday. One administrator described it as, "technology integration is so seamless it is like water – you can't imagine life without it because it is so fundamental to what you do". On the other end

of the spectrum are schools where only a handful of teachers are fully embracing the technology. Some schools have teachers who instruct students to not bring their computers to class. During our interviews (April, 2011), one student told us that he had not been required to use his netbook once during class time during the entire school year. Another student at the same school, however, indicated she used her computer in class virtually every day.

We did not observe much difference in the degree of technology integration when comparing MLTI schools with netbook schools. We saw high usage as well as low usage in both types of schools.

Lack of resources for technology training has a significant impact on the extent to which technology is used in the classroom

At least some administrators and teachers in virtually every school we visited acknowledged that they have a long way to go to make full use of 1:1 technology. Some teachers said they know that there are web sites and tools that would be very useful for them in their teaching, but they don't know what they are. Other teachers talked about being frustrated with professional development offered in their school because it was either at a too high or too low level for them to benefit. A couple of administrators talked about how their school had started offering professional development sessions but had suspended them due to other intervening priorities. Though they were unable to offer professional development at the time, they hoped to do so again in the future. We also met some teachers who described doing very little with the laptops and showed little interest in doing more.

Resources were often cited as a major barrier to making integration happen. Technology staff at many of the schools we visited put the majority of their focus on keeping the devices and networks up and running. They acknowledged that training and support for teachers is important but admitted that they do not have the resources to do the type of training (or hire the technology integrators) they feel their schools need. As a result, professional development is not robust at these schools. Many of the schools are piecing together professional development opportunities for their teachers when they can, but are relying heavily on internal expertise (a few knowledgeable teachers to help spread the word and mentor other interested teachers).

- MLTI offers professional development and a number of teachers mentioned participating in MLTI training (even among netbook teachers). Some teachers had attended trainings when they taught at the middle school level. But teachers also expressed the need for professional development/support that is available in their own school when they needed it. This was true in both MLTI schools and netbook schools.

- Rural schools perceived an even greater barrier to professional development because they have difficulty freeing up teachers' time so they can attend training, because substitutes with content area expertise are so hard to find (when, for example, one teacher teaches all the science classes in the school). One teacher

indicated that when she attended training, the best she could hope for was a "babysitter" for the students – they didn't learn anything when she was out of the classroom.

Technology support is critical to the success of a 1:1 program

There appears to be a threshold of technology support necessary for a 1:1 program to grow and thrive. (Establishing thresholds for how much support is necessary is beyond the exploratory scope of this study). Not surprisingly, in schools that do not have enough infrastructural support (e.g. not enough bandwidth during certain parts of the day, long wait times to get answers/help from the technology team, long repair time turn-around which results in students coming to class without devices, unpredictable filtering or too much filtering without easy bypass routes for teachers, devices not deployed until late fall because there are not enough people to image the machines during the summer) a successful program is much more elusive. This is in part because users must exert so much effort to overcome these obstacles. We heard quite a few schools say that they had been forced to cut back on technology support for 2011-2012 due to extreme budget pressures.

In the schools where the IT department is perceived as a partner with teachers, staff and administrators, there appeared to be much more use of technology in the classrooms. In schools where the IT department is seen as rather disconnected from every day realities of the classroom (as one teacher put it, "they don't really understand the extent to which teachers need 'just in time' support when suddenly, for example, students can't access a website needed for a final exam") or where the IT department appears to the users to be "overwhelmed" with service requests, teachers seem to struggle more in moving forward with technology integration. In one school we visited, the IT department was seen as a gatekeeper and as hostile to teacher efforts to use technology in their classrooms. This school struggled with technology more than the others we visited.

Highest use teachers describe themselves as "self-taught"

The highest-level users of technology were teachers who described themselves as "self-taught" and actively sought training and opportunities to learn from colleagues, often on their own time. Some reported paying their own way to take a class. These teachers often voluntarily assisted less tech-savvy teachers in their schools and were seen by other teachers as a source of support for technology help.

The percentage of students attending class with a device ready to use was strongly related to the level of technology integration in the school

There were significant differences between schools in the percentages of students who come to class every day with their devices charged and ready to use. In some schools, the use of the computers is so built into the culture of the school that it appears that most kids don't even think about arriving in class without their computer. A principal in one such school told stories of high school students breaking down in tears when their computers

were taken away for disciplinary reasons. Other schools, in contrast, report that only about 50% of the students show up on any given day with their laptops.

- From our interviews we estimate that for a school to have a culture of technology built into learning at the school, about 85% or more of students must regularly show up to class (for most classes) with their computers. Those schools where fewer than 85% had a laptop or netbook in class had much lower usage of technology.

- The differences between the schools with high use and lower use seemed to reflect the expectations of the principal and teachers. In schools where the principal set expectations for technology use, teachers used more technology. In classes where teachers consistently used technology, students regularly showed up for class with their laptops charged and ready. One teacher indicated that there was joint pressure – teachers expected students to show up to class with their devices, but it worked the other way as well. Having students arrive with computers put some pressure on the teacher to make use of them.

Community support strengthens the 1:1 program

Another factor that seemed to have a substantial impact in the use of computers in schools was the amount of support in the community for the program.   Some communities appear to value the technology and view it as a privilege for their children to have it. On the day the students are to receive their devices, virtually every student shows up to school with a signed permission slip. Other communities seemed much more leery of the technology and were more resistant to allowing their children to be assigned a device. Confirming the reasons for these differences was beyond the scope of this research, but it was clear that program management was much easier for the schools where there was strong community support. Those schools spent less time worrying about how they were going to collect money for damaged devices, for example.

- One possible reason for stronger community support is the degree to which the schools use technology in parent interactions (presentations and communication) as well as in sharing examples of student work.

- It appeared that there was somewhat stronger community support among MLTI schools than among netbook schools, although we are not able to explain why that might be true.

- There is some anecdotal information that income levels are a factor; teachers suspected that parents with limited financial resources were more reluctant to take on the potential liability in event of a breakage.

Filtering

Some schools "lock down" the Internet very tightly to try to prevent student access to inappropriate sites or sites that will distract them from being "on task" during class time. Other schools are much more free with their access, pointing out that the "real world" also provides lots of distractions and students must learn to manage their own behavior. Students, however, appear to be quite capable of accessing blocked sites by using proxy servers.

Within the schools that lock down their Internet, teachers and students are able to access needed sites if they are provided methods for bypassing the filters (for example, teacher passwords for temporary access). When bypass options are cumbersome or severely restricted, it is much more challenging for teachers and students to reach the sites they need. The devices are used much less when the hurdles for access to the Internet are high.

Benefits to Student Learning: The potential power of the 1:1 devices to benefit student learning is inspiring.

Innovative teaching and engaged students

Some of the teachers who have embraced the technology in their classrooms and actively sought to use the devices in innovative ways have created dynamic, exciting learning environments for their students. All schools are able to cite examples of learning taking place in their classrooms that would not be possible (or would be much more limited) without 1:1 devices—Senior multimedia portfolios, community-based research projects, differentiated ELA literature studies using online textbooks with different reading levels built in, blogging in social science classes, completing self-paced mathematics problems and homework, online remedial programs for struggling students, special online courses in small schools that cannot offer a wide array of courses, interactive World Language websites, and access to foreign media and museums to supplement classroom learning, to name a few.

Level playing field

Many administrators, teachers and students told us that one of the main benefits of 1:1 devices in high schools is the "leveling of the playing field" that ensures that all students have access to technology regardless of socio-economic status. We heard again and again about the large numbers of students who do not have access to a computer at home.

Schools in rural areas described the devices as enabling students to connect to the world beyond their small communities. With 1:1 technology students have access to experts and resources from all over the world.

Access for all, especially SPED, ELL and students with different learning styles

Access is also a seen as a great benefit for ELL and Special Education students who are able to utilize online programs and software that erase barriers (like speech to text) and enable them to produce more, and engage more, in their learning. One administrator indicated that he expects to see an increase in assessment scores within a few years that will reflect enhanced learning for these groups of students.

Computers also benefit students with different learning styles by connecting them with content in myriad ways.

Preparation for post-secondary technology requirements

Teachers and administrators spoke often about how providing students with laptops helps prepare them for the world they will face after high school, either in college or the workforce. Some felt that using Microsoft Office (or the open software equivalent) is important.   Other teachers did not feel that learning specific software programs is important but that student experience using computers, accessing information and learning to evaluate that information is what is important.

Student-centered learning replaces teacher-centered teaching

A couple of teachers described how the laptops have transformed their teaching style from being a "teacher-centered" or "chalk and talk" approach to a "student-centered" approach where the teacher's role in the classroom is to guide and facilitate learning, not deliver content. Student-centered teaching, one teacher told us, is what enables students to develop the critical thinking skills they will need to succeed in the 21st Century. This evolution toward student-centeredness is supported by prior findings in surveys of middle school teachers.

Increased Learning and Improved Test Scores

One participating school has documented significant student growth on NWEA tests as a result of utilizing an online remedial math program called ALEKS in all 9th grade Algebra I classes. Prior to 1:1, only 20 students per year were able to utilize the program in the computer lab. Now, all 9th graders work with ALEKS on a regular basis (10-15 minutes a day). Students not meeting standards are catching up while more advanced students are accelerating their learning. Next, the school plans to find a program that can help students with grammar because student data indicates that grammar is a weak spot in their ELA program.

"Just in time" teaching and learning

Questions that arise in class can be explored immediately by searching for answers on the Internet. A few teachers spoke of the value, especially in social science classes, of being able to gather information immediately as needed to facilitate class discussions.

Efficiency

The 1:1 devices enable more efficient use of time because they free students from having to wait for a computer in a lab or having to transfer documents from machine to machine on flash drives. Teachers described how difficult it was prior to 1:1 to get access to the computer lab for their classes. They often had to sign up weeks in advance.

Quite a few of the high school seniors we spoke with indicated that their laptops had been invaluable in helping them apply for college (filling out applications, writing essays, etc.) and many couldn't imagine completing all of the application materials without the use of their computer.

Some One-to-One Downsides
In addition to the many benefits to student learning offered by 1:1 technology, there are also some significant challenges/downsides including off-task behavior and social media bullying (or "drama") brought into the schools.

Off-task behavior among students and the resulting challenge it presents for teachers was by far the most often cited downside of the 1:1 programs, even among schools that block all social media sites. It did appear, however, that when technology is integrated into the classroom and culture of the school, teachers had fewer reports of off-task behavior. Teachers who regularly use the devices in authentic ways that engage students reported significantly less off-task behavior. Those teachers indicated that the benefits to the technology far exceeded the downsides. On the other hand, some teachers seemed much more negative about the students having 1:1 devices and said it was virtually impossible to prevent students from the distractions of websites (games, etc.) during class because they could not monitor what every student was doing on his or her device.

"Drama" from social networking sites used at home and then brought into school the next day (or even during the day) was a problem cited by several administrators. One superintendent described it as bullying that has gone underground. "No one hits anyone anymore" he said, "they just post negative or hurtful comments on Facebook."

Perception of devices – MLTI laptops vs. netbooks

MLTI MacBooks are perceived to be better devices than netbooks, but many feel netbooks are sufficient and would not want to lose access to them.

Virtually everyone acknowledged that the MLTI MacBooks are superior devices to netbooks, although not everyone felt that high schools need the power or software offered by the MacBooks.

- Among the MLTI schools we visited, no one told us they didn't like the MLTI machines or they weren't powerful enough or didn't have the software they needed to work on projects required for school.   In fact, one teacher said that the very old (6 years plus) Apple laptops the school used upon occasion were more powerful than their new netbooks.

- Quite a few students, teachers and administrators at netbook schools readily admitted that they felt the machines were inferior to MacBooks. As one administrator said, "They [the students] had Toyota Camrys with automatic transmissions and air conditioning [in middle school] and we told them they are now getting Aveo hatchbacks with standard transmissions [in high school]." But he went on to say that the netbooks get the job done and it was all the school could afford and he was appreciative that they were able to provide them.

- Students said the netbooks were slow, had small screens and didn't support having multiple windows open at a time but that they were also "better than nothing." When asked to indicate how much they would care if the netbooks were taken away, (1=wouldn't care at all, 10=would care a lot), virtually everyone indicated at least a 5 or better. Many said "10" – they couldn't imagine going back to life before everyone had a 1:1 device.

The administrators in the schools that selected netbooks said that the decision to do so was a financial one. Some, although not all, indicated they would prefer having MacBooks if they could afford them. A few felt that MacBooks are expensive and not necessary to do the work the teachers in their schools require.

For those making full use of technology integration in the classroom, however, netbooks may not provide sufficient power or software.

Several teachers reported that they had "hit the wall" with the netbooks and that the machines were not powerful enough to handle the assignments they had planned in their classes (math calculations for graphing, multimedia presentations, etc.). All of these teachers were at the same school where students regularly do a lot of work using the netbooks and where every teacher is required to have an online presence (online classroom, website or blog). It should be noted that the use of computers at this school was substantially greater than what we typically saw at the other netbook schools we visited. For the majority of schools, however, the netbooks appeared to be adequate for what most (though not all) teachers were requiring them to be used for.

Durability and downtime of devices: netbooks are durable, but appear to be less reliable.

The netbooks were perceived, in general, as being a bit more durable than the MLTI laptops because the screens are much smaller (and therefore not as "wobbly"). However, because the netbooks are smaller, many students "shove them" into their backpacks where they get crushed against books and other items. MLTI laptops, on the other hand, are kept in separate cases and are not carried together with books in backpacks and are less likely to get "crushed". (Note: Administrators at several schools observed that high school students

in general treat their devices with less care than the middle school students in the same district.)

We heard significantly more complaints among netbook users about device downtime than we did among MLTI users. The netbooks seem to be less reliable. A couple of teachers explained that during class when they ask students to open their netbooks sometimes some of the devices just don't work. Or, 80% of the students can access a particular web site and 20% cannot, or students get "kicked off" the network and then have to re-boot their netbook to get back on. One teacher did acknowledge that students may be causing at least some of the problems because they use the netbooks like they use other computers (multitasking, etc.) and the netbooks just aren't powerful enough in her opinion to handle the demands students place on them. In comparison, we heard few complaints about MLTI laptops not working. It must be kept in mind that the MLTI laptops have been deployed in schools for many years now and there is more internal experience with their capabilities and how to use them.

Repairs: a time-consuming task for all, and particularly for netbook schools.

All schools reported that keeping devices in working order (repaired, imaged) is a time-consuming task. For MLTI schools, the laptops must be sent to the depot for repair, which involves tracking and mailing. For the netbook schools, some are able to send the devices out for repair to a "depot-like" repair center, while others do the repairs in-house which saves money but takes a considerable amount of IT staff time and resources.

We saw evidence that some schools are struggling to keep devices repaired and in the hands of students and it appears that this is much more of a problem at netbook schools than MLTI schools. It also appears that it is more of a problem in schools with one-year warranties. Once the warranty expires on the netbooks, the school is left with the option of paying an outside vendor for repairs (costly), doing the repairs in-house (further stressing the technology staff that already appear to stretched to maximum capacity), or spending money not budgeted to replace aging devices.

Some netbook schools reported that students did not have the use of their device for a period of up to several weeks once it was sent in for repair. This was problematic for teachers who regularly use the devices in class. One school solved this problem by purchasing an additional 10% buffer pool of machines for use as loaners when netbooks were out for repairs. Most schools did not have extra netbooks to lend to students, however. MLTI schools did not report long delays in getting devices repaired and returned to students.

- A couple of netbook high schools negotiated a deal with their vendor to get "MLTI-like" warranty and repair coverage (including a repair "depot" where laptops could be mailed to be repaired) as well as battery replacement for 3 years. One school was able to include accident coverage in their warranty.

Costs

Among netbooks schools, costs per year per device ranged from $75 to $118 (the range of years of expected deployment is 3-5 years.). The least expensive devices were those without software (Linux, using open software and cloud computing).

Almost all netbooks schools are expecting the life of their devices to last longer (3-5 years) than their warranties (1-3 years).[1] It is unknown at this point how much it will cost to keep the machines running once they are 4-5 years old and off warranty. Two netbook schools that are currently off warranty report spending $17-$18 per device per year (allocated across all devices). MLTI schools report spending the same amount, on average, to cover the cost of repairs not covered by the MLTI program.

Summary

- Netbooks are a less expensive 1:1 option for schools than MLTI MacBooks and for many schools it appears that netbooks offer sufficient capability to meet existing teacher and student needs. Schools that are robustly integrating technology into a large percentage of classrooms, however, find that the netbooks lack sufficient power.

- The MLTI program seems to be easier to launch and maintain because so many of the details important to managing a program are taken care of: Repair Depot, device tracking, software included, etc. A netbook program requires more staff time and resources to run, especially in schools without long-term, full warranty coverage. As machines age, they will likely strain resources further.

- The infrastructure in place to support the devices, including the all-important technology support staff, appears to be more important to the success of a 1:1 program than the type of device deployed. Many teachers perceive the integration of technology into their classrooms as a daunting task, and without sufficient support to remove technology barriers (e.g. broken machines, help when a web site crashes during an exam, etc.), adoption of the technology will likely be slow.

- In a world of limited resources where hiring additional technology staff is not an option for many schools, self-taught, motivated teachers who can share their knowledge and enthusiasm with other teachers at their schools are an important resource. Fostering their efforts in a systematic way could potentially increase the technology adoption in a number of schools.

- The more computers are integrated into the culture of the school (through daily announcements, daily SAT question, projects required of every student (e.g., a Gateway project in 10th grade to review the first two years and plan the final two, Senior exit exhibits to demonstrate meeting standards, etc.) the more the devices will become a catalyst to changing the way students learn in Maine high schools.

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[1] One exception is a high school that negotiated a lease for 3 years with a full-warranty (including batteries but excluding accident coverage). At the end of the 3 years the school is planning to acquire replacement devices, thus avoiding the expense of maintaining aging machines. Cost of the lease is $118 per year (at the end of which the students will be able to purchase them for between $11-$15 each). The price included Microsoft Office.

Table 2: Summary of Device Comparisons

	MacBooks	**Netbooks**
Pros	• Start up of a high school 1:1 program is easier with MacBooks than netbooks and requires fewer internal resources • Powerful machines and software (teachers and students are not limited by device performance and can produce sophisticated assignments and projects)	• Less expensive than MacBooks, at least in terms of initial start-up costs** • At current implementation levels, most users will probably find the computing capacity of the devices adequate for their intended uses with high school students.
Cons	• More expensive than netbooks **	• Netbooks seem to be less reliable than MacBooks (more downtime). As programs are established, reliability may be less of an issue. • We estimate that netbook programs will require more technology staff time to manage the program (especially in schools with limited warranties). • Higher-level technology users may find the machines are not powerful enough to perform tasks/produce products required of students.

** This qualitative study is unable to report robust cost information. However, the cost-per-device, including warranty, was significantly less expensive on an annual basis for all schools we spoke with than the cost of MLTI participation. Preliminary repair costs not covered by MLTI or netbook warranties are roughly equal from the limited data we have, although the repair costs for netbooks could rise considerably as the devices age. What is not included in the cost data is opportunity costs as technology support staff are focused on managing and maintaining netbooks and resources are unavailable to support teachers in their technology integration efforts.