Initial Report: Evaluation Study of the Progress of the North Carolina 1:1 Learning Initiative (Year 1)

Submitted to
Howard Lee, Chairman
North Carolina State Board of Education

Rob Hines
North Carolina Department of Public Instruction

Submitted by:
Jenifer O. Corn, Ph.D.
Jason W. Osborne, Ph.D.
Elizabeth O. Halstead
North Carolina State University
and the William and Ida Friday Institute for Educational Innovation

Other Contributors:
Lori Holcomb, Ph.D.
Kevin Oliver, Ph.D.
Ruchi Patel
Daniel Stanhope
Jennifer Tingen
Megan Townsend

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Executive Summary

The Friday Institute for Educational Innovation at NC State University conducted an evaluation of the first year implementation of the one-to-one (1:1) learning pilot initiative, which involved seven Early College High Schools (ECHS) and one traditional high school with a total across the eight schools of approximately 2000 students and 200 school staff. In these schools, every teacher and student received a laptop computer and wireless Internet access was provided throughout the school. The goal of the initiative is to use the technology to improve teaching practices, increase student achievement, and better prepare students for work, citizenship, and life in the 21st century.

A group of comparison schools, similar in type, size, student demographics, and student achievement on the prior year English and Algebra I End-of-Course tests were selected to provide comparative data from schools not implementing 1:1 programs. Many of the comparison schools had a significant amount of technology available for instructional purposes.

This first year evaluation focused on the schools progress toward implementing the 1:1 environment and the barriers, successes, and lessons learned in the early stages of implementation. A combination of teacher and student surveys, focus groups and interviews, classroom observations, and analyses of existing school-level data was used. At the time of this report, the 2007-2008 School Year (SY) End-of-Course test and other student outcome data collected by NCDPI were not yet available.

The implementation of the 1:1 program proceeded on different timelines for the traditional high school and the ECHSs. In the traditional school, the steps required to prepare the teachers, the technology support staff, and the school infrastructure took place prior to the start of the 2007-2008 SY, so students were able to receive their computers in September 2007 and the evaluation considers this the first full year of implementation. The ECHS schools, on the other hand, were first informed of their involvement in the 1:1 pilot in September 2007, so that teachers did not receive laptops until November 2007 and students until March or April 2008. Data about classroom use in these ECHS schools are therefore limited to the last months of the school year.

In the first year these schools appear to have implemented the critical building blocks of an effective 1:1 computing environment. Teachers received professional development in important areas and had time to acclimate to their laptops before students received theirs; school infrastructures, policies, and staff were put into place; parents were informed about the 1:1 initiative and agreed to their responsibilities; students appear to have been relatively well prepared to receive and use their laptops; technology facilitators played an important role in helping teachers integrate these new technologies into the instructional life of the classroom; and students and teachers have begun using the computers in a wide variety of ways to support teaching and learning.

With this progress, many lessons have been learned that can inform future work at the 1:1 pilot schools and other schools that may implement 1:1 environments in the future. The largest overall lesson is that laying the groundwork for students to receive their laptops takes time. Preparing teachers to integrate the technology into instruction and preparing all the other essentials for a successful 1:1 initiative (e.g., getting the wireless infrastructure in place, developing the needed policies and preparing for their implementation and enforcement, engaging parents, hiring technology facilitators and technicians, and
acquiring the necessary software and hardware to go with the laptops) needs to be done before a school is ready to distribute student laptops. Teachers and administrators agreed it would be best to plan to distribute student computers at the start of a school year, so the planning and preparation have to begin during the prior school year.

Other key lessons from the year one evaluation include:

- **Ongoing professional development is imperative.** Professional development needs to be continuous and directly meet the needs of teachers as they become more proficient at using the technology to enhance teaching and learning.

- **Defining the appropriate balance between student safety, acceptable use, and access to web-based resources is difficult.** While very complex, it is also important to find ways to meet student safety needs, set acceptable use requirements, and avoid viruses, spyware, and hacking, without overly limiting what teachers and students can access and do with the computers. Models of how to create the right balance are needed.

- **Classroom management strategies and tools require further exploration.** Teachers continue to look for guidance on classroom management in 1:1 classes, but have found that the technology solutions offered to them have limitations and, in some cases, did not function as claimed and were not worth using. Further attention needs to be directed to classroom management strategies and how they can be best supported with technological tools.

- **Skilled Technology Facilitators play a significant role in the success of technology integration into classroom practices.** The important role of onsite technology facilitators to help teachers and students use the technology to improve learning, established in prior research, was once again confirmed.

- **Careful short- and long-term budget planning is important to the success and sustainability of the 1:1 initiative.** Many resources are needed to support the use of the computers, ranging from displays to printers to specialized equipment for science experiments to content-specific software. Budgets need to be planned to include these resources and their immediate upkeep and support, as well as long-term costs of replacing hardware and supplies (e.g., expensive projector bulbs, ongoing software licenses, replacement of obsolete, damaged laptops).

- **Attending to the details makes all the difference.** Having ways to plug-in computers and charge batteries, make printer supplies available, establish email class lists for teachers, backup teacher and student machines, respond promptly to technical problems, and address the many other day-to-day needs of making the use of 1:1 laptops go smoothly in classrooms is essential for successful use of the technology to improve student learning.

- **Broad-based engagement of key stakeholders can facilitate sustainability of the 1:1 initiative.** It is important for schools to engage representatives from the school, district, college partners, business partners, and the community to help inform planning; guide decision-making; provide support to the students, teachers, staff and administrators; and support the sustainability of the 1:1 initiative.
Evaluation Study of the Progress of the
North Carolina 1:1 Learning Initiative (Year 1)

In the spring of 2008, the North Carolina State Board of Education awarded a contract to the Friday Institute for Educational Innovation, part of the College of Education at North Carolina State University, to evaluate the one-to-one (1:1) learning pilot initiative in eight North Carolina high schools with a total of approximately 2000 students and 200 school staff. In these 1:1 pilot schools, every teacher and student received a laptop computer and wireless Internet access was provided throughout the school. The goal of initiative is using the technology to improve teaching practices, increase student achievement, and better prepare students for work, citizenship, and life in the 21st century.

This report presents the initial findings from the first year of the pilot including:

- An evaluation of the schools progress toward implementation of the 1:1 environment;
- A summary of lessons learned and challenges to be considered as schools begin year two of the pilot project and other schools consider implementing 1:1 initiatives.

Seven of the schools participating in the 1:1 pilot are Early College High Schools (ECHS), which differ from traditional high schools in many ways. These schools, located on the campuses of two- and four-year colleges and universities, are intended to attract students from groups that are often under-represented in college: minorities, students from low-income families, and those whose parents never attended college. Students in Early College High Schools graduate with both a high school diploma and two years of transferable college credit or an associate's degree. In most cases, early college students stay in high school five years to complete those college courses. Early College High Schools have just begun in the past few years, supported by the Learn and Earn initiative signed by Governor Easley in 2004, and receive guidance and support from the NC New Schools Project. These schools are typically very small, with an average of 100 students and eight teachers at the seven 1:1 pilot schools.

The 1:1 pilot also included one large traditional high school implementing a 1:1 environment, with 1200 students and 86 teachers. This is a large, long-established urban school with a diverse student population.

The schools participating in the 1:1 pilot were selected prior to the involvement of the Friday Institute and without consideration of any research design. While there is interest in comparing the impact of 1:1 programs in ECHS versus traditional schools, having only one traditional high school implementing the 1:1 learning environment is a major limitation of the research. In addition, the implementation in this traditional school began prior to the research project. Therefore, the data do not support direct comparisons of the two types of schools.

It is important to note that at the time of this report the End-of-Course (EOC) test data, as well as student outcome data such as attendance, expulsion, and other data collected by the NC Department of Public Instruction for the 2007-2008 School Year (SY) was not yet available. Furthermore, since ECHS students received their computers late in the school year, and time was spent learning to use the computers, it is premature to expect impact on test scores in these schools.
To provide comparative data for the ECHS 1:1 pilot schools, we selected seven matched comparison ECHS schools that are not currently implementing 1:1 environments. Similarly, we selected one matched traditional high school for comparison with the 1:1 pilot traditional high school. The selection process produced a group of comparison schools that were as similar to the 1:1 pilot schools as possible regarding variables such as teachers’ gender, race and ethnicity, and level of experience with instructional technology; and data about students’ scores on prior-year English I and Algebra I EOC Tests and about students’ home Internet connectivity. In addition, data from the 2008 North Carolina Teacher Working Conditions Survey (Teacher Working Conditions Initiative, 2008) confirmed similarities among teachers’ perceptions at the 1:1 and comparison schools for items related to instructional technology and leadership. It is important to note that the NCDPI Annual Media and Technology Report (AMTR) data from 2007 indicated that the comparison schools did have a significant amount of technology available for instructional purposes, ranging from student-computer ratios of 1.23 to 5.62.

Progress Toward Implementation of a 1:1 Environment

Through classroom observations, focus groups, surveys, and analysis of existing data, we have examined the progress toward implementation of a 1:1 environment, barriers, concerns, and successes encountered, and have formulated a series of lessons that have emerged as well as suggestions for action and improvement based on our first year of data collection.

Research (Muir, Manchester, & Moulton, 2005; Penuel, 2006; Rockman, 2000) identifies important features that define a successful 1:1 learning environment in schools. These critical features consist of an adequate management and technical infrastructure (including connectivity, a wireless network, hardware and software resources, and school procedures/policies), professional development (PD), technology support personnel, and the use of the laptop by teachers and students leading to changes in instructional practices and student learning outcomes. This prior research informed our evaluation in terms of the data we collected.

Key Milestones for the 1:1 Pilot Implementation

The implementation of the 1:1 pilot proceeded on different timelines for the traditional high school and the ECHSs. In the traditional school, teachers received their laptops in March 2007 and professional development during the spring and summer of 2007. The technology and support infrastructure was also put into place during that same time period—installing the wireless network, imaging (loading standard software on) the student laptops, hiring support personnel, developing policies, etc., so that the school was ready to distribute laptops to the 1,266 students in September 2007. This school was able to follow a recommended schedule for preparing teachers and the school staff and infrastructure during the school year and summer prior to issuing computers to the students, and having students receive those computers at the start of the school year.

The funding for the ECHSs, by comparison, was not approved until August 2007 and the schools were selected the following month, without any application procedure or determination that the schools were prepared to begin the implementation process. The computer bid process was initiated in September 2007, teachers received their computers and some professional development in November, and then schools worked to get the technology infrastructure, personnel, and policies in place. Informational sessions were held for parents, and laptops were
distributed to students during March and April 2008, close to when schools begin to focus on preparing students for their end-of-course exams. This implementation schedule created a great deal of pressure on the schools and made the first year of the implementation much more challenging, when compared to the approach the traditional school was able to take. One clear recommendation is that schools should have at least six months planning and preparation time before distributing laptops to students. Furthermore, it is best if this can be done during the prior school year, so that teachers can plan for students to receive their laptops at the start of the new school year.

The timeline for the implementation in the ECHSs and the traditional school is shown in more detail in Table 1.

Table 1. Timeline for 1:1 Initiative Rollout

<table>
<thead>
<tr>
<th>1:1 Traditional HS</th>
<th>1:1 ECHS</th>
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<tbody>
<tr>
<td>March 2007</td>
<td>Laptops distributed to teachers.</td>
</tr>
<tr>
<td>April 2007</td>
<td>Wireless network installed, laptops imaged, technology support personnel hired, laptop policies/procedures developed, and professional development provided to teachers.</td>
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<td>May 2007</td>
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<td>June 2007</td>
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<td>Aug. 2007</td>
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<tr>
<td>Sept. 2007</td>
<td>Parent information sessions held.</td>
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<tr>
<td>Oct. 2007</td>
<td>All 1:1 pilot teachers attend content-specific PD.</td>
</tr>
<tr>
<td>Nov. 2007</td>
<td>All 1:1 pilot administrators/TFs attend a leadership PD.</td>
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<tr>
<td>Dec. 2007</td>
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<tr>
<td>Jan. 2008</td>
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<tr>
<td>Feb. 2008</td>
<td>Initial site visit by evaluation team.</td>
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<tr>
<td>March 2008</td>
<td>Data collection site visits by evaluation team.</td>
</tr>
<tr>
<td>April 2008</td>
<td>1:1 online surveys for leaders, teachers, and students collected.</td>
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<tr>
<td>May 2008</td>
<td></td>
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</table>
Laying the Groundwork for a 1:1 Environment

Much of the information in this section pertains to the ECHSs only, since the traditional high school had its infrastructure and technology staffing in place before the start of the evaluation.

Connectivity to the School

Working with the staff of the School Connectivity Initiative, each ECHS 1:1 school underwent a technology evaluation that assessed their current infrastructure and made recommendations on how to move forward on upgrades and connectivity. Two of the schools already had connectivity to their LEA wide area network. Each of the other sites secured metro-Ethernet connections from their preferred providers. This connection was brought to the community college campus to offset the additional bandwidth load created by the 1:1 laptop initiative, and to link students to the resources of their LEA and the North Carolina Research and Education Network (NCREN). In particular, one of these schools in the western part of the state serves as a model for the future connectivity planning. The community college and the LEA were both part of the Western Educational Network and NCREN, which allowed network traffic to be logically separated without adding an additional connection.

Wireless Network

Wireless access points were added to the schools that did not already have them. One ECHS already had wireless coverage in the dedicated high school portion of the site, and another ECHS was in the process of installing wireless before this project was announced. Meetings were held with community college officials to ensure networks would not interfere with each other. LEAs and community colleges were encouraged to interconnect their networks so students had network access while in college courses. Many LEAs chose not to take this approach, therefore leaving many students "stranded" while in their college courses. This remains a problem to be resolved so that ECHS students can use their computers while attending college courses. By the time student laptops were distributed, all but one of the ECHS schools had configured an adequate wireless network, meaning the teachers and students could access the school/district network while on the dedicated high school area of the campus. Due to some difficulties with a local Internet service provider, compounded by the age of the building, one ECHS was only able to provide access to the Internet in two classrooms.

Hardware and Software Resources

Lenovo and Apple were the laptop vendors for the ECHSs, selected through a bid process managed by NC DPI and the New Schools Project. One school selected Apple Macbook computers, two selected Lenovo tablet PCs, and the other five ECHS schools received Lenovo laptops. The traditional high school selected Hewlett-Packard laptops for teacher and student laptops. All Windows-based districts received DyKnow classroom management software, but after encountering many technical difficulties, one district has since decided to move to another classroom management solution starting 2008-2009 SY. Classroom management on the Apple laptops is done through Apple Remote Desktop. All schools received licenses for Microsoft Office, however one school has decided to move to OpenOffice as their school district moves toward 1:1 computing in all high schools in 2008-2009 SY. All schools had access to the SAS Curriculum Pathways software under the state license. In addition to the Office Suite, districts
installed their standard software loads on the laptops. Some schools also added additional educational software packages, such as Geometer Sketchpad, based on the focus of the ECHS.

School Policies and Procedures

All schools in the 1:1 pilot enacted policies and procedures governing how the laptops were to be used. A survey of their policies and procedures showed that:

- All eight schools had acceptable use guidelines;
- All eight schools had guidelines for caring for the laptops;
- Six schools explicitly prohibited violent games and social networking sites;
- Six required original software to remain on the laptop and four prohibited students from installing anything on the laptop. Three of these schools had random inspections to insure compliance;
- Seven schools collected insurance fees, ranging from $10-$50, from students;
- Seven allowed students to take their laptops home every day;
- Seven schools indicated they would collect the laptops during the summer; and
- Every school hosted one or more parent nights to provide information to parents about the 1:1 initiative, and get parental approval and commitment to support their child’s use of the laptop;
- All eight schools required parental permission forms for students to receive a computer.

Professional Development

During the 2007-2008 SY, a number of professional development experiences were available to teachers in the 1:1 pilot schools through the 1:1 Collaborative at the Friday Institute, the New School Project 1:1 Project Coordinator, and at individual schools provided by school or district technology staff. The primary professional development offering consisted of a two-day session for teachers grouped by content areas (math, science, English/language arts, and social studies). At each of these sessions, the program included an introduction to the use of the computers and the DyKnow classroom management software by the vendors, an introduction to the content-relevant SAS Curriculum Pathways software conducted by SAS staff, an introduction to other uses of technology in the content area by faculty from NC State University and staff of the Friday Institute, and a visit to 1:1 classrooms at Centennial Campus Middle School or Cary Academy. In general, most teachers rated these professional development experiences as high quality, timely, meeting their needs, and furthering their understanding of integration of instructional technology into their classrooms. Some of the most valued topics included content-specific sessions focusing on project based learning, managing change in the classroom, using the Internet in classroom instruction, new literacies, and student-generated content. A one-day session was also provided for principals from the 1:1 pilot schools. This session introduced the use of the technology and ways in which it can be integrated into the classroom, as well as panel discussions with experienced principals from 1:1 schools about management and leadership issues. The 1:1 ECHS staff attended an additional day of training at the Summer Institute organized by the North Carolina New Schools Project (NSP) focusing on special issues related to implementing a 1:1 project that included sessions on online literacy, NSP Instructional Objectives, lesson modeling, and fine-tuning of technology integrated lesson plans. Additional professional development was offered at the 1:1 schools by their technology facilitator or through the district technology staff. These sessions included calendar software, DyKnow,
interactive whiteboard, Geometer's Sketchpad, iPhoto, Introduction to laptops and troubleshooting, Plato, video design and editing, podcasting, virtual learning environments, webpage design, and SAS Curriculum Pathways.

**Technology Support Personnel**

In previous evaluations, such as the Project IMPACT Evaluation, we have consistently found that a skilled Technology Facilitator (TF) can have significant benefits to teachers and subsequently to students. An effective TF supports teachers instructional needs related to technology by collaboratively developing technology-integrated lessons, modeling the use of technology for teaching and learning, and identifying useful digital resources to enhance lessons. This role is distinct from those of school-level technology directors or technicians who focus their efforts on addressing the school’s technical needs – networking issues, troubleshooting hardware malfunctions, and acting as the liaison with district technology personnel.

Five 1:1 schools identified and hired a TF by the end of the Fall 2007 semester. Two schools had some difficulty, but eventually found two local teachers with the appropriate mix of experience and interest to fill the role of TF during the Spring 2008 semester. One school took a unique approach and identified four lead teachers across the content areas to collectively act as TFs. Consistent with prior evaluation findings, the 1:1 teachers reported that TFs substantially assisted them in integrating their laptops into the curriculum.

**Evaluation Findings**

**Use of Technology for Teaching and Learning: The Teacher Perspective**

A hallmark of implementation of the 1:1 computing environment is the use of the technology in day-to-day instruction. As indicated by the figures below, the percentage of teachers who reported using their computers for both planning and conducting instructional activities were substantially higher in the 1:1 schools than in the comparison schools. It is important to note that this finding occurred after the teachers had their laptops for only three months and the students only had their laptops for approximately one month.
Analyses of data from the 1:1 traditional high school and the comparison school yielded similar results in that teachers at the 1:1 traditional school were generally more likely to use computers for daily planning and instructional activities than teachers at the comparison school, as shown in the figures below.
In addition, as the figures below indicate, reports from the ECHS teachers show that students in 1:1 computing environments were more likely than students in comparison schools to use technology daily in activities such as seeking information, analyzing information, self-assessment, communication, and submitting assignments.
Analyses of data from the 1:1 traditional high school and comparison school yielded similar results in that the teachers from the 1:1 high school were more likely to report daily use of computers by students in a variety of learning activities.

Figure 6. Percent of 1:1 and Non-1:1 Traditional High School Teachers Reporting Students’ Daily Use of Computers in Various Learning Activities
Use of Technology for Teaching and Learning: The Student Perspective

Students were asked to report on the daily use of laptops in the core content courses. As shown in the figure below, students at the 1:1 ECHSs reported significantly higher daily use of the laptops than students at the comparison sites for every core subject area.

*Figure 7. Percent of 1:1 and Non-1:1 ECHS Students Reporting Daily Use of Computers in the Core Content Courses*

![Bar graph showing daily use of laptops by 1:1 ECHS and Non-1:1 ECHS students across core subjects.]

Analyses of data from 1:1 traditional and comparison schools yielded similar patterns in that students in the 1:1 traditional school were more likely to use computers in core classes than those in the comparison school. In the traditional schools, however, the largest disparities between the 1:1 and comparison school were found to be in science and social studies, rather than language arts and math as with the ECHSs.

*Figure 8. Percent of 1:1 and Non 1:1 Traditional High School Students Reporting Daily Use of Computers in the Core Content Courses*

![Bar graph showing daily use of laptops by 1:1 Traditional and Non-1:1 Traditional students across core subjects.]

Similar to the self-reported data provided by the teachers, students at the 1:1 ECHS reported higher frequencies of daily use of technology for various learning activities than students in the comparison schools.

We also collected information on how technology was used by students for various learning activities, see Figures 9 and 10. While this data suggests more use in the majority of these categories in the 1:1 schools, given the limited amount of time students had access to their laptops and relatively small differences between groups; it is premature to draw conclusions about relative technology use between the schools. These data will serve as baseline for interpretation of student technology use in the future.

Figure 9. Percent of 1:1 and Non-1:1 ECHS Students Reporting Using Computers in Various Learning Activities

Analyses of data from 1:1 traditional and comparison schools yielded similar patterns of results to that reported for the ECHSs.
Our observations when visiting classrooms at the 1:1 schools provided data that confirms that the computers were used frequently in the classrooms. For example, over 50% of our observations saw teachers use their computer and display; 28% of the observations also saw them use embedded hardware such as a whiteboard, GPS/GIS, or student response systems; 85% of the time we saw students use their computers for learning activities; and 20% of the time students also used math or science equipment (such as digital microscopes, science measurement probes, or GPS devices). Students often used Internet resources, productivity software (word processing, spreadsheet, presentation), or subject-specific software such as Geometer’s Sketchpad.

**Challenges and Recommendations**

We conducted two site visits and one focus group with teachers and administrators at each of the eight schools, with a total of 71 participants in the focus groups. The focus group questions addressed the requirements necessary for a successful 1:1 program in the areas of management and technical infrastructure (including a wireless network, hardware and software resources, and school procedures/policies), technology support personnel, professional development needs, and the use of the laptop by teachers and students leading to changes in instructional practices and student learning outcomes, as well as challenges and lessons learned. A series of challenges, needs, and recommendations emerged from the focus groups and interviews. The major findings are summarized in the following sections.
Management and Technical Infrastructure

School Network
- Some buildings were very old and needed to be retrofitted with the necessary electrical wiring to support the power needs of the laptops, projectors, whiteboards, printers and other equipment.
- There was inconsistency in access to the wireless system across locations in some schools. Staff and students reported that the strength of the wireless system could be vastly different from room to room or within areas of a single room, which interferes with effective use of the laptops. Teachers noted that support staff could move or add wireless access points to address these problems effectively.
- In most cases, there was no space on the school-based or district-provided servers to support a virtual drive for storing student work. Students were instructed to save their work on flash drives or their hard drive, which was not backed up on a regular basis. Teachers indicated that a central drive for students and teachers to save work and to back up important data is essential.

School Policy and Procedures
- A major challenge reported by teachers was the limited battery life and the lack of easily accessible outlets for charging. Outlets were not easily accessible from student and teacher desks or workstations, and teachers cited safety concerns when power cords had to run across the classroom floor. Staff and students complained about a lack of outlets to charge laptops and suggested having charging carts available at school to address this issue, in addition to adding more outlets.
- Staff raised issues of security and storage for laptops when students are at school. Also identifying a reliable, easy-to-use tracking system for the laptops.
- Staff and students were frustrated by the “Deep Freeze” on computers. Drives were set so that new settings or software could not be saved onto the computer, and teachers and students were not provided with administrative level privileges on their computers.
- Printing issues are frequently reported. Most students want to have access to the printers at school. However, staff were concerned about the exorbitant cost associated with “reckless” printing.
- School staff want the district to provide student email accounts so that teachers and students can communicate readily and teachers can create email lists of their classes.
- Teachers and students expressed a lot of frustration with the virus attacks on their laptops. They found that laptops were not protected when students and staff used them at home, and then infected files could be transmitted via email or flash drives when returned to school. They request better policy and technical solutions to this issue.
- Both students and teachers commented on how strict filtering systems and prohibitions against loading software or files can be a barrier. Some filtering systems blocked educational and informational websites. In other cases, teachers might ask students to save or download files to be used in lesson plans but would be unable to do so in some schools. Some teachers admitted they recommended students do their research at home, where it is not filtered.
• School staff raised concerns about unanticipated expenses necessary to support the laptop project including software site licenses, print toner cartridges, print paper, online textbook resources, additional batteries, and rewiring/retrofitting old buildings.

Process for Rollout

• Teacher Preparation: Teachers often expressed frustration at the timing of the laptop distribution, particularly where receipt of the laptops did not coincide with professional development in using them. Lack of sufficient training prior to receiving the laptops meant one of the biggest barriers was general lack of knowledge and familiarity with laptops, software, and Internet resources. A principal suggested that “teachers get [the laptops] before school ends, they get all summer with the laptops to do professional development, and then students get them in the fall when they get back - that’s definitely the ideal.” In considering future 1:1 computing programs, teachers and administrators agree that it would be desirable to have extensive professional development prior to utilization of the laptops in the classroom.

• Community Engagement: Building commitment to the project from everyone involved, including teachers, parents, students, community members, the community college, and district personnel is vital to successful project implementation and sustainability. Some teachers were concerned about a lack of buy-in from staff due, in part, to a lack of clear vision or understanding about the purpose of the project. One teacher said, “I think we really need more of a vision of what we want to do year one, year two…This is what is going to happen, consequences, action plan, deadlines things like that.”

• Student Training: Students suggested providing before or after school training to students about use of the laptop and various hardware, software, or digital resources; maintaining and keeping laptops up to date; and troubleshooting techniques.

Laptop Care

• In some instances a significant barrier was having one or more students in a class without a laptop due to maintenance, forgetfulness, or (in some schools) their family not paying the required insurance or other fee. Teachers suggest that schools should purchase additional laptops for students to borrow so they can plan for all students to have laptops available during each class.

• Teachers mentioned that their students seemed over-burdened with backpacks, laptop cases, purses, etc. Most of these schools don’t have lockers available for students so there are some issues with students safely storing laptops during lunch. Limited access to the laptops for some of the students was a constant concern due to maintenance, repair, discipline, or neglecting to bring laptops to class. One student suggested an option could be “a [laptop] case that rolls for people who have a hard time carrying it because of all the weight of all my school supplies.” Also, schools might be able to eliminate the need for carrying textbooks and notebooks with electronic textbook adoption and adoption of easy-to-use software for note taking and organizing.

Hardware and Software Resources Needed

• Hardware, equipment, and supplies that support effective use of laptops for teaching and learning including: storage carts designed for battery recharging, additional batteries, interactive whiteboards with remote slates, projectors, printers/toner/paper, science-
specific peripherals (e.g. digital microscopes, digital devices for measuring temperature, chemical composition, motion), web cameras, microphones, speakers, external hard drives, and flash drives.

- Software that supports effective use of laptops for teaching and learning including: online textbooks; video editing software; course management software (e.g. Blackboard, Moodle); content specific software for math, science, foreign language, history, English, geography, grammar; student email; TI calculator integrator; audio books; and, podcasting/video hosting capability.

**Monitoring Student Work**

- Many teachers raised the issue of monitoring student work. They want to be able to monitor students’ activities to ensure they are staying on task and not using the laptop inappropriately. Schools thought DyKnow would provide a great software-based solution to this issue, but unfortunately, it did not work out that way. Teachers described DyKnow as unreliable, slow, disruptive, and frustrating. Some teachers suggested the possibility of loading DyKnow or other classroom monitoring software on an existing classroom desktop to free up their new laptops for instruction. They recommended finding different technologies or software for achieving the same goal of monitoring student activity.

- Many teachers expressed concern about student activities online and how to ensure students were on task. In contrast, and not surprisingly, many students expressed a strong desire to have more freedom online and individualizing their laptops.

**Professional Development**

During focus groups, teachers identified a large set of specific professional development needs, which include the following:

- **Content-specific professional development** on the use of technology to enhance teaching and learning in each core discipline (math, science, social studies, and English/language arts). Teachers recommended that this training introduce specific tools applicable to the subject area that prepare teachers to use technology to support project-based-learning activities.

- **Hands-on activities** that provide opportunities for teachers to engage with the technology as learners themselves in order to help prepare them to incorporate the technology in their teaching. These activities should introduce basic technology skills as well as classroom uses of specific resources such as OneNote, SAS Curriculum Pathways, formative assessment tools, blogs, wikis, podcasts, digital video tools, GoogleEarth, Geometer’s Sketchpad, course management systems (e.g., Moodle, Blackboard), and content-specific, web-based resources.

- **Instructional strategies** to help them address students’ multiple learning styles with the laptops and create a paperless classroom.

- **Lesson planning sessions** that provide guidance and time to develop classroom activities that integrate curriculum content and technology. Teachers recommended that these sessions focus on real-world applications and enable teachers to work together.

- **Site visits** to 1:1 classrooms and interactions with teachers who have experience teaching in 1:1 environments.
• **Assessment with technology** including tools for planning, developing, creating, storing, and assessing e-portfolios.
• **Levels of professional development** to address teachers at different levels of fluency with technology and experience integrating technology into the curriculum.
• **Classroom management and policy issues** including acceptable use, student safety, cyber-bullying, copyright, laptop storage, battery charging, and technology to monitor student use.
• **Opportunities to interact and collaborate** with other teachers to share best practices, lessons learned, and effective resources for the use of laptops in given content areas, and with different students’ learning styles.
• **On-going support** through social networks that allow teachers to communicate with other 1:1 teachers in their subject area and share lessons, resources, and experiences.
• **More time to practice.** Teachers felt they were expected to implement dramatic changes to their instructional practices, lessons, but were not provided time to plan to do so. They expressed a need for planning time to build their technology skills with the new hardware and software, locate resources, collaborate with other teachers to build cross-curricular lessons and projects, and create new lessons that effectively integrate technology.

Note that the professional development opportunities provided during the first year of implementation began to address many of these needs, but the teachers found that the time available was too limited and that professional development needs to be ongoing in order to address the full range of elements required to ensure success of the 1:1 programs.

**Technology Support Personnel**

• As mentioned earlier, in previous evaluations, such as for Project IMPACT, we have found that a skilled Technology Facilitator can have significant benefits to teachers and subsequently to students. Consistent with this prior finding, the 1:1 teachers reported that Technology Facilitators substantially assisted them in integrating their laptops into the curriculum and that having time with a Technology Facilitator available on a regular basis is an important support for teachers integrating technology into classroom practices.
• Although most staff and students recognized that their technology support personnel were working hard, a large number of comments indicated that the overall support they received this first year was inadequate. One focus group participant stated the need for “some planning up front, so that those people and resources are in place before things are actually rolled out.” Others suggested using guidelines, like the Project IMPACT guidelines, to determine the number of support positions such as technology facilitators and technicians “because that can get real overwhelming, and things can start to fail, projects can start going bad if we don’t have the support in place up-front.”
• Facilitating clear communication between the technical support staff at the school and district sometimes proved challenging for the teachers, who indicated they sometimes needed a translator to get the help they needed.
• Some schools have found that creating a “Student Technology Team” that addresses minor, troubleshooting issues during the school day can be effective and enable the professional technology support staff to focus on the more complex problems.
Student Recommendations

Students were eager:

- To utilize their laptops every day in every class;
- For increased access to engaging educational websites and digital resources and games;
- For studying assistance (test prep software and textbook electronic resources);
- For more opportunities to interact with their peers using the computer for class (for group projects, collaborative lessons, and research projects); and
- For each teacher to have a website for their courses where students could go for announcements, links to course-specific websites, downloading presentations and notes, and submitting assignments.

Summary

In the first year these schools appear to have implemented the critical building blocks of an effective 1:1 computing environment. Teachers received professional development in important areas and had time to acclimate to their laptops before students received theirs; school infrastructures, policies, and staff were put into place; parents were informed about the 1:1 initiative and agreed to their responsibilities; students appear to have been relatively well prepared to receive and use their laptops; technology facilitators played an important role in helping teachers integrate these new technologies into the instructional life of the classroom; and students and teachers have begun using the computers in a wide variety of ways to support teaching and learning.

With this progress, many lessons have been learned that can inform future work at the 1:1 pilot schools and other schools that may implement 1:1 environments in the future. The largest overall lesson is that laying the groundwork for students to receive their laptops takes time. Preparing teachers to integrate the technology into instruction and preparing all the other essentials for a successful 1:1 initiative (e.g., getting the wireless infrastructure in place, developing the needed policies and preparing for their implementation and enforcement, engaging parents, hiring technology facilitators and technicians, and acquiring the necessary software and hardware to go with the laptops) needs to be done before a school is ready to distribute student laptops. Teachers and administrators agreed it would be best to plan to distribute student computers at the start of a school year, so the planning and preparation have to begin during the prior school year.

Other key lessons from the year one evaluation include:

- **Ongoing professional development is imperative.** Professional development needs to be continuous and directly meet the needs of teachers as they become more proficient at using the technology to enhance teaching and learning.
- **Defining the appropriate balance between student safety, acceptable use, and access to web-based resources is difficult.** While very complex, it is also important to find ways to meet student safety needs, set acceptable use requirements, and avoid viruses, spyware, and hacking, without overly limiting what teachers and students can access and do with the computers. Models of how to create the right balance are needed.
• *Classroom management strategies and tools require further exploration.* Teachers continue to look for guidance on classroom management in 1:1 classes, but have found that the technology solutions offered to them have limitations and, in some cases, did not function as claimed and were not worth using. Further attention needs to be directed to classroom management strategies and how they can be best supported with technological tools.

• *Skilled Technology Facilitators play a significant role in the success of technology integration into classroom practices.* The important role of onsite technology facilitators to help teachers and students use the technology to improve learning, established in prior research, was once again confirmed.

• *Careful short- and long-term budget planning is important to the success and sustainability of the 1:1 initiative.* Many resources are needed to support the use of the computers, ranging from displays to printers to specialized equipment for science experiments to content-specific software. Budgets need to be planned to include these resources and their immediate upkeep and support, as well as long-term costs of replacing hardware and supplies (e.g., expensive projector bulbs, ongoing software licenses, replacement of obsolete, damaged laptops).

• *Attending to the details makes all the difference.* Having ways to plug-in computers and charge batteries, make printer supplies available, establish email class lists for teachers, backup teacher and student machines, respond promptly to technical problems, and address the many other day-to-day needs of making the use of 1:1 laptops go smoothly in classrooms is essential for successful use of the technology to improve student learning.

• *Broad-based engagement of key stakeholders will facilitate sustainability of the 1:1 initiative.* It is important for schools to engage representatives from the school, district, college partners, business partners, and the community to help inform planning; guide decision-making; provide support to the students, teachers, staff and administrators; and support the sustainability of the 1:1 initiative.
References


