Mid-Year Evaluation Report on the Progress of the North Carolina 1:1 Learning Technology Initiative (Fall Semester, Year 2)

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.
North Carolina State University
and the William and Ida Friday Institute for Educational Innovation

Other Contributors:
Rodolfo Argueta, Ed.D.
Elizabeth Halstead
Clara Hess
Jessica Huff
Kevin Oliver, Ph.D.
Ruchi Patel
Daniel Stanhope
Jennifer Tingen

January 27, 2009
Executive Summary

The Friday Institute for Educational Innovation at the NC State University College of Education submitted an evaluation report of the first year of implementation of the One-to-One (1:1) Learning Pilot Initiative in September 2008. This report presents the evaluation of progress at mid-year of the second year as the next step in the planned three-year evaluation. These pilot schools include seven Early College High Schools (ECHS) and one large traditional high school, with a total across the eight schools of approximately 2300 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 report focuses 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 intent of the evaluation is to provide information about the value of the initiative to enhance student learning, as well as to identify challenges to the successful implementation of 1:1 programs, strategies for meeting those challenges, and services and supports needed to enable successful programs throughout the State.

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. 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.

At the mid-point in year two of this evaluation, we can see significant progress with implementation of the 1:1 pilot. The eight schools participating in the pilot (along with their matched comparison schools we are studying) allow us to draw the following conclusions:

Infrastructure and Support

- Most pilot schools have wireless internet access, printers, and projectors in most classrooms. Twenty percent of classrooms report not having printer access, and students report lack of internet access in temporary classrooms. We also observed that many school networks have difficulty keeping up with demands when many students are on the network at once. It is going to be a continuing challenge to keep up with connectivity demands as more students use more bandwidth-intensive internet applications.
- There has been almost no loss or theft of laptops, and limited breakage except for the tablet-style PCs, which experienced substantial breakage rates. We suggest using repair records to make future purchase recommendations.
• Students experiencing breakage sometimes had to go up to two weeks without a laptop when repairs required manufacturer involvement and there were no laptop loaners available. Schools should have plans to ensure smooth replacement of student and/or teacher laptops when they need repair (e.g., extra laptops that can be used as temporary loaned units, network backup of student and teacher work)

• Technical support personnel at the schools were generally considered to be doing an excellent job. However, more support resources are needed to help teachers move instructional technology to a more central role in classroom pedagogy. Teachers noted that principals and instructional technology facilitators were generally quite supportive.

Policies and Procedures

• Most schools made policy changes for this year to address issues identified in Year 1. These changes improved procedures and can help inform additional schools implementing 1:1 programs.

• One significant policy issue continues to be content filtering, which too often prevents students and teachers from accessing important internet resources. To the extent students are prevented from accessing important resources, 1:1 environments will not achieve full potential. Schools need more support in addressing the requirements of the Children’s Internet Protection Act (CIPA) while providing access to valuable education resources.

Professional Development

• All schools engaged in substantial professional development. There is a clear need for ongoing professional development, customized to the participants’ stage of developing in using technology to enhance teaching and learning. While overall teachers rated the professional development they received highly, evaluations of individual professional development workshops should be used to improve future workshops.

• An important aspect of professional development is the “just-in-time” mentoring a technology facilitator (TF) can provide. As these schools move forward, they need to ensure the TF is focusing on instructional support and professional development, not technical support that should be provided by technicians.

• Teachers want not only to learn how to use technology, but they also want to see models of how to effectively incorporate technology into their routine pedagogy.

Technology Attitudes and Skills

• In general, teachers felt confident in using a wide range of technologies in their classroom, and their confidence has increased since last year.

• In general, students felt confident in using a wide range of technologies. Due to high levels of confidence in the prior evaluation, we did not see significant improvement in this area.

• Teachers felt that technology significantly improves learning opportunities for students, but also acknowledge that it significantly complicates classroom management and adds substantial work for teachers. Future evaluations will examine whether these issues change as teachers become more familiar with using technology and have and share technology-enhanced lesson plans.
### Changing Instructional Practice

- Teachers in 1:1 environments are using laptops more frequently than last year for activities such as producing homework, assessing student work, managing information, communicating with families, and collecting performance data.
- Teachers are most frequently using laptops for presenting content and other instructional activities, but are also being innovative such as involving students in virtual field trips, accessing online resources, and interacting with online guest speakers.
- Teachers across the major core content areas are using laptops and technology frequently. Math teachers appear to be least likely to use laptops on a daily basis, and often use calculators instead. This may be appropriate, however, depending on the class and content. TFs may want to identify more ways for math teachers to incorporate technology into the daily life of the class.
- Teachers are taking advantage of connectivity in interesting and important ways, such as asynchronous collaboration through resources such as Google Docs.
- Teachers express a need for sophisticated course management options such as Moodle or Blackboard.

### Student Outcomes

- End of grade/course test scores will be analyzed in subsequent reports.
- There are initial indications in some of the 1:1 high schools that early withdrawal (student dropout) may be reduced during the early implementation phase of a 1:1 learning project. This is a preliminary finding that should not be broadly disseminated until confirmed as a continuing trend.
- Both classroom observations and teacher reports indicate that students may be more engaged in learning and classroom activities in 1:1 environments. However, this could be a novelty effect and will need to be confirmed in future evaluations to determine whether it is a continuing trend. Additionally, laptops can be a significant distraction if not managed properly.
- Students in 1:1 schools indicated they felt they were benefitting in development of 21st century skills, compared to students in comparison schools. Further, teachers report that students are using laptops more this year than last year in ways that support 21st century skill acquisition.

The pilot schools continue to build on the critical components of an effective 1:1 computing environment. Adjustments were made to school infrastructures, policies, and staff resources to meet new teaching and learning needs; technology facilitators continued to play a critical role in helping teachers effectively integrate these new technologies into the classroom; teachers received professional development in important areas and are beginning to make significant changes in their instructional practices; and, students are adapting to and benefiting from the use of laptops in their schools.

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. The largest overall lesson is that it takes administrators, teachers, and students time to adjust to the significant, systemic changes enabled by the introduction of a 1:1 learning environment.

The key lessons identified from the year one evaluation still apply during the first semester of year two:

- **Ongoing professional development is imperative.** Professional development needs to be continuous, designed to directly meet the needs of teachers, and customized to the participants’ level of
expertise/experience as they become more proficient at using the technology to enhance teaching and learning. Additionally, teachers need opportunities to collaborate and share successful lessons for a 1:1 classroom environment.

- **Defining the appropriate balance between student safety, acceptable use, and access to web-based resources is difficult but important.** 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. To the extent students are prevented from accessing important resources, 1:1 environments will not achieve full potential. Schools need more support in addressing the requirements of the Children’s Internet Protection Act (CIPA) while providing access to valuable education resources. Models of how to create the right balance need to be explored.

- **Classroom management strategies and tools require further investigation.** Teachers continue to look for guidance on issues related to management of 1:1 classes such as student monitoring systems, and collecting and returning student work. Further attention needs to be directed to classroom management strategies and how they can be best supported with technological tools, such as effective monitoring software; centrally-located server resources to provide a protected space for students to save work; and, centrally-supported course management software such as Moodle or Blackboard.

- **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 store and carry laptops safely, 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.

In addition to the continued focus on the lessons identified during year one, the year two evaluation report also highlighted the importance of effective leadership for the successful implementation of a 1:1 learning environment.

- **Consistent, supportive, distributed leadership promotes adoption and buy-in from teachers and students for the 1:1 learning innovation.** Key characteristics emerged from the conversations with teachers at the 1:1 pilot schools for school leaders to successfully support a new 1:1 laptop project including supporting teacher professional growth, setting reasonable expectations for effective
technology integration, modeling technology use, readily addressing instructional and technical needs, and communicating commitment to the purpose of 1:1 learning initiative.
Mid-Year Evaluation Report on the Progress of the North Carolina 1:1 Learning Technology Initiative (Fall Semester, Year 2)

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 2300 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 this initiative is the utilization of 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 mid-year report on progress toward Year 2 objectives for the participating 1:1 learning initiative pilot schools. This report highlights important milestones and progress, including a summary of changes in classroom instruction to date; and, challenges and recommendations.

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: racial 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 started operations 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 150 students and eight teachers at the seven 1:1 pilot schools.

The 1:1 pilot also included one large traditional, long-established urban high school with a diverse student population of 1300, as well as 86 teachers. 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 was 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 was a major limitation of the research. In addition, the implementation in the traditional school began prior to the evaluation and prior to the implementation in the ECHS schools. Therefore, we could not make direct comparisons between 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 behavioral referrals, expulsion, and other data collected by the NC Department of Public Instruction (NCDPI) for the 2007-2008 School Year (SY) is not yet available for analysis. Publically available data from NCDPI, such as monthly attendance and early withdrawal numbers, is included in this report. Furthermore, since students in most of the participating schools received their laptops at the end of last academic school year, it was premature to expect a substantial effect of the intervention on major student outcomes (such as EOC/EOG test scores) in these schools.

To enhance the scientific rigor of this evaluation we gathered comparative data for the ECHS 1:1 pilot schools from seven matched comparison ECHS schools that were not 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 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.

The traditional pilot high school received laptops in the fall of 2007 and the seven ECHS pilot high schools received their laptops in spring 2008. The data summarized in this report were gathered from surveys distributed to the ECHS and their comparison schools in late September 2008, while the traditional high school and the comparison school completed the surveys in October 2008. Surveys were designed for three distinct groups: administrators (principal, assistant principal, technology facilitator, guidance counselor, etc.), classroom teachers, and students. Items on the comparison school surveys focused on the use of “computers” in school versus the use of “laptops” in the 1:1 pilot school surveys. Observational site visits at the eight pilots were completed in October 2008, and included classroom observations, interviews with school technology facilitators, and separate focus groups with school leadership and teacher teams. For reference, data collection tools, including surveys and focus group protocols, are provided in Appendix A.

Through these classroom observations, focus groups, surveys, and analyses of existing data, we have examined the progress toward implementation of a 1:1 environment. These efforts have enabled us to identify important milestones and progress and major challenges and recommendations based on the data from the first few months of the second year of implementation.

**Important Milestones and Progress**

**Evaluation Question 1: How have school infrastructures and support systems evolved to meet staff and students’ 21st century needs?**

**Infrastructure/Tools**
For the most part, staff at the 1:1 schools were pleased with progress of the infrastructure at their schools. Table 1 provides a summary of the current technical infrastructure (hardware, wireless access, and peripherals) at each of the pilot schools. The 1:1 pilot schools have wireless Internet access in 91% of their classrooms, printer access for more than 80% of their classrooms, interactive whiteboards in 50% of their classrooms, and projectors in 85% of their classrooms. Students at the traditional high school reported that a lack of Internet access in classes held in the trailers/mobile units was a significant access issue. Another limiting factor is connection bandwidth, which did not appear to be sufficient when a substantial number of students were connected to the network. Thus, it appears that schools need to ensure connectivity in all areas of the school and that bandwidth is adequate given the substantial demands of student usage.

**Table 1. Current Inventory of Technical Infrastructure**

<table>
<thead>
<tr>
<th>School</th>
<th>Number of Teacher Laptops</th>
<th>Number of Student Laptops</th>
<th>Number of High School Classrooms</th>
<th>Classrooms with Wireless Internet Access</th>
<th>Classrooms with Printers</th>
<th>Classrooms with Interactive Whiteboards</th>
<th>Classrooms with Projectors</th>
</tr>
</thead>
<tbody>
<tr>
<td>ECHS1</td>
<td>5</td>
<td>115</td>
<td>5</td>
<td>5</td>
<td>4</td>
<td>5</td>
<td>5</td>
</tr>
</tbody>
</table>
Table 2 provides a summary of the number of teacher and student laptops that were lost, stolen, or broken, as well as the number of laptops that had to have the hard drives reimaged during the school year. Theft and loss of laptops appears not to be a substantial issue at this point. The single biggest problem reported by the schools with laptops was the durability of the screens. The schools with tablets identified broken styluses and screen latches as the biggest problem areas. Some teachers reported that the use of a single bag for both laptop and books caused laptop screen breakages, and recommended having a separate, small carrying case for the laptop. In the next round of data collection, we will further explore and document the causes and solutions to the repair issues. However, from this initial data, it may be prudent to review the types of machines schools are purchasing and the ways schools encourage students to transport their units to reduce this issue.

## Table 2. Record of Laptop Loss and Repairs since the 1:1 Learning Initiatives Began - Fall of 2007 for the Traditional High School and Spring of 2008 for the ECHS

<table>
<thead>
<tr>
<th>School</th>
<th>Number Teacher Laptops</th>
<th>Number Student Laptops</th>
<th>Number of High School Classrooms</th>
<th>Classrooms with Wireless Internet Access</th>
<th>Classrooms with Printers</th>
<th>Classrooms with Interactive Whiteboards</th>
<th>Classrooms with Projectors</th>
</tr>
</thead>
<tbody>
<tr>
<td>ECHS2</td>
<td>8</td>
<td>124</td>
<td>8-10</td>
<td>8-10</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>ECHS3</td>
<td>4</td>
<td>106</td>
<td>9</td>
<td>9</td>
<td>0</td>
<td>0</td>
<td>7</td>
</tr>
<tr>
<td>ECHS4</td>
<td>13</td>
<td>227</td>
<td>13</td>
<td>13</td>
<td>12</td>
<td>4</td>
<td>13</td>
</tr>
<tr>
<td>ECHS5</td>
<td>6</td>
<td>145</td>
<td>5</td>
<td>5</td>
<td>6</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>ECHS6</td>
<td>12</td>
<td>152</td>
<td>9</td>
<td>9</td>
<td>9</td>
<td>8</td>
<td>7</td>
</tr>
<tr>
<td>ECHS7</td>
<td>10</td>
<td>173</td>
<td>10</td>
<td>9</td>
<td>10</td>
<td>10</td>
<td>0</td>
</tr>
<tr>
<td>Trad HS1</td>
<td>89</td>
<td>1357</td>
<td>64</td>
<td>All but the trailers</td>
<td>64</td>
<td>30</td>
<td>64</td>
</tr>
<tr>
<td>Totals</td>
<td>187</td>
<td>2399</td>
<td>124</td>
<td>114</td>
<td>104</td>
<td>62</td>
<td>105</td>
</tr>
</tbody>
</table>

- **Table 2. Record of Laptop Loss and Repairs since the 1:1 Learning Initiatives Began - Fall of 2007 for the Traditional High School and Spring of 2008 for the ECHS**

<table>
<thead>
<tr>
<th>School</th>
<th>Type of Laptop</th>
<th>TEACHER Laptops</th>
<th>STUDENT Laptops</th>
<th>Most Common Issues</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Lost Stolen Required Repair Reimaged</td>
<td>Lost Stolen Required Repair Reimaged</td>
<td>Broken Screens LCD Latch Motherboard Freezing on boot up Stylus Spill</td>
<td></td>
</tr>
<tr>
<td>ECHS1</td>
<td>MacBooks</td>
<td>0 0 1 (20%)</td>
<td>0 0 1 (1%)</td>
<td>X</td>
</tr>
<tr>
<td>ECHS2</td>
<td>Lenovo T61</td>
<td>0 0 2 (29%)</td>
<td>0 0 6 (5%)</td>
<td>20 (16%)</td>
</tr>
<tr>
<td>ECHS3</td>
<td>Lenovo T61</td>
<td>0 0 0 0</td>
<td>0 0 9 (8%)</td>
<td>0</td>
</tr>
<tr>
<td>ECHS4</td>
<td>Lenovo Tablet X61</td>
<td>0 1 (8%) 0 0</td>
<td>0 0 206 (91%) 5 (2%)</td>
<td>X</td>
</tr>
<tr>
<td>ECHS5</td>
<td>Lenovo Tablet X61</td>
<td>0 0 0 0</td>
<td>1 (1%) 1 (1%) 15 (10%) 145 (100%)</td>
<td>X</td>
</tr>
<tr>
<td>ECHS6</td>
<td>Lenovo T61</td>
<td>0 0 0 0</td>
<td>0 0 3 (2%)</td>
<td>3 (2%)</td>
</tr>
<tr>
<td>ECHS7</td>
<td>Lenovo T61</td>
<td>0 0 0 0</td>
<td>0 0 10 (6%)</td>
<td>25 (15%)</td>
</tr>
</tbody>
</table>
One open-ended item on the 1:1 online survey asked respondents to list the three or four software tools most frequently used in classes. The most commonly used software tool (see Table 3) among teachers, administrators, and students is productivity software (e.g. Microsoft Office). Both teachers and students reported using internet browsers to access a variety of online resources for academic/school-related purposes and publishing software (e.g. Microsoft PowerPoint, Publisher). Teachers, administrators, and students reported using personal information software, such as iCal, Outlook, GroupWise, and Novell. Teachers and administrators indicated they frequently used classroom management software (e.g. DyKnow, EduPlatform). See Appendix B for a complete list of the software tools most frequently used in 1:1 pilot school classes.

**Software Tools**

*Table 3. Number of times a type of software was named when survey respondents listed the three or four software tools most frequently used in classes.*

<table>
<thead>
<tr>
<th>Software Tool</th>
<th>Administrators (n = 29)</th>
<th>Teachers (n = 101)</th>
<th>Students (n = 791)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>General Software</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Productivity</td>
<td>31</td>
<td>78</td>
<td>865</td>
</tr>
<tr>
<td>Internet browsing</td>
<td>8</td>
<td>27</td>
<td>403</td>
</tr>
<tr>
<td>Personal information management</td>
<td>11</td>
<td>13</td>
<td>22</td>
</tr>
<tr>
<td>Publishing</td>
<td>10</td>
<td>42</td>
<td>548</td>
</tr>
<tr>
<td>Illustration</td>
<td>0</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>Image editing</td>
<td>1</td>
<td>3</td>
<td>64</td>
</tr>
<tr>
<td>Audio recording and editing</td>
<td>0</td>
<td>3</td>
<td>23</td>
</tr>
<tr>
<td>Video recording and editing</td>
<td>1</td>
<td>6</td>
<td>14</td>
</tr>
<tr>
<td>Web authoring</td>
<td>1</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>Media players</td>
<td>1</td>
<td>4</td>
<td>41</td>
</tr>
<tr>
<td>Online resources</td>
<td>10</td>
<td>40</td>
<td>96</td>
</tr>
<tr>
<td><strong>Instructional Software</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>School management</td>
<td>5</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Lesson planning</td>
<td>1</td>
<td>8</td>
<td>0</td>
</tr>
<tr>
<td>Instructional delivery</td>
<td>0</td>
<td>15</td>
<td>28</td>
</tr>
<tr>
<td>Classroom management/monitoring</td>
<td>2</td>
<td>35</td>
<td>97</td>
</tr>
<tr>
<td>Course management</td>
<td>1</td>
<td>4</td>
<td>0</td>
</tr>
<tr>
<td>Course specific</td>
<td>4</td>
<td>38</td>
<td>17</td>
</tr>
<tr>
<td>Assessment/test preparation</td>
<td>2</td>
<td>11</td>
<td>27</td>
</tr>
</tbody>
</table>
Some teachers suggested that access to more technical and instructional support was needed from both the school and district. According to those teachers, their schools did not have enough personnel (e.g., computer/network technicians, media coordinators, instructional technology coordinators). Some students also pointed out that when their laptops broke, they would sometimes have to go without them for up to two weeks until they were repaired. These delays most commonly occurred when machines had to be sent back to the manufacturer for repair. Both points are significant concerns since laptops and instructional technology play central roles in the instructional process. Thus, from a policy perspective, LEAs and schools considering moving to 1:1 environments need to pay close attention to technical and instructional support resources to ensure the technology can fulfill its role in the pedagogy of the school. Furthermore, schools should have plans to ensure smooth replacement of student and/or teacher laptops when they need repair (e.g., extra laptops that can be used as temporary loaned units, network backup of student and teacher work).

### Technical Support Personnel

**District Technology Staff**

In the 1:1 pilot districts, the number of full-time staff working in the district technology office ranges from 5 to 14. Some districts have contracts with as many as 14 network engineers. The typical district technology staff is comprised of a wide area network engineer, technicians, and instructional technology and technology facilitators.

**Technicians**

Four of the 1:1 pilot schools have a full-time technician on staff and three schools have part-time technicians funded through a combination of grant and local funds. Two of the pilot schools do not have any on-site technicians assigned to their schools and must rely on the district technology staff for all their technical support needs. Major responsibilities of the technician include responding to teacher/student requests related to software, hardware, and network problems; installing new technology resources; acting as liaison with district technical staff; coordinating warranty and other technical information with hardware and software companies; and providing input on school technology purchases.

**Student Tech Teams**

Student tech teams are being coordinated by the technology facilitator (TF) at some of the 1:1 schools. Often these student volunteers are being trained by the TF and technician to support the 1:1 initiative. Student tech teams’ tasks include helping determine consequences for breaking rules related to inappropriate technology use, creating weekly news and sports broadcasts, and providing initial troubleshooting technical support to their teachers and peers. Some students receive service hour credit for their time spent on the student tech team.

### Instructional Support Personnel

**Technology Facilitators**

Teachers felt that technology facilitators were a vital component to a successful 1:1 project. Six of the 1:1 pilot schools hired a full-time TF. One school took a unique approach and identified four lead teachers across the content areas to collectively act as TFs.

The TFs reported that their daily activities included conducting professional development, troubleshooting equipment and software issues, modeling technology use, and co-teaching. They also reported maintaining open communication with district technology staff as part of their regular routine.
Some examples of their daily activities included facilitating collaborative planning sessions with teachers, providing teacher training after school if schedules prevented common planning time, using OneNote software for lesson-sharing, setting up a Google Blog to support collaboration among teachers, and coordinating parent nights to exhibit student work and provide parent technology training.

*My role [as the TF] is supporting the teachers. . . . You have the teachers who you give them anything they’re going to run with it. We have at least one or two teachers who are terrified of this stuff, so to get them doing it, my role is being there when they’re using it in the classroom, so they don’t have the terrible experience and never want to use it again.*

Specific items on the student, teacher, and administrator surveys asked about adequacy of the school infrastructure to support the laptop project. There were no significant differences between EC teachers at the 1:1 and non-1:1 schools in regards to agreement that the technology infrastructure was adequate to support their technology use except related to technical support personnel (see Figure 1). This was a major accomplishment for the 1:1 schools since the amount of technology was so much greater. It is interesting to note that the 1:1 teachers were slightly lower in agreement about the adequacy of available software. The 1:1 EC teachers may not have realized they needed or wanted additional software resources until they got unlimited access to hardware in their classrooms.

*Figure 1. Percent of 1:1 (n = 57) and Non-1:1 (n = 42) ECHS teachers indicating agreement that their schools have various technology infrastructure components in place.*

*Note. *This indicates that there was a statistically significant difference between groups (p < .05).*

Teachers at the traditional 1:1 high school were more likely to agree that their principal encouraged them and their TF supported their efforts to integrate technology into the curriculum than the comparison school (see Figure 2). However, the teachers at the traditional 1:1 high school also reported significantly less satisfaction with technical support response time, or that their school provided the necessary support to enable them to feel prepared to use their laptops for planning and instruction. The traditional 1:1 high school teachers seemed to have an increased need of support and expectation of support with unlimited access to technology in their classrooms.

*Figure 2. Percent of 1:1 (n = 58) and Non-1:1 (n = 69) traditional high school teachers indicating agreement with their schools having various technology infrastructure components in place.*
More than 90% of 1:1 EC students agreed (see Figure 3) that the infrastructure at their school was adequate to support their laptop use, and about 90% agreed that available software met their learning needs. More than half of the students reported that they were pleased with the teachers’ use of laptops in the classroom, that they frequently used new technology tools, and that their school helped them feel prepared to use their laptops.

Figure 3 Percent of 1:1 ($n = 901$) and Non-1:1 ($n = 665$) ECHS students indicating agreement with their schools having various technology infrastructure components in place.

Note. *This indicates that there was a statistically significant difference between groups ($p < .05$).

Students in the traditional 1:1 high school were more likely to agree (see Figure 4) that the infrastructure at their school was adequate to support their laptop use, that they frequently used new technology tools, and that their school helped them feel prepared to use their laptops than students at the comparison school. Students at the traditional 1:1 high school were less impressed with the available software and with their teachers’ use of the laptops than students at the comparison school or the 1:1 EC.

Note. *This indicates that there was a statistically significant difference between groups ($p < .05$).
Figure 4. Percent of 1:1 (n = 921) and Non-1:1 (n = 948) traditional high school students indicating agreement with their schools having various technology infrastructure components in place.

Note. *This indicates that there was a statistically significant difference between groups (p < .05).

Policy/Procedures
All schools in the 1:1 pilot enacted effective policies and procedures governing how the laptops were to be used. In the last report, the following summary of laptop policies and procedures was provided:

- 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.

It is of interest to note what changes were made to these policies by the schools as they began a new school year. At least one participating school made each of the following adjustments to their laptop policies:

- Taking the Laptops Home
  - Students were allowed to take laptops home this year. Last year, students were able to take them home for only two weeks.
  - Parents were offered the choice of not allowing the child to bring the laptop home. Some parents chose this option.
  - The software installation policy was changed to grant parents administrative rights under certain conditions. The TF created a temporary administrative account that lasted one or two days for parents who needed to install a printer or configure the laptop to access a wireless network at home. Parents were required to attend extra training before an administrative account was created for them.

- Emphasis on Copyright
  - Teachers facilitated regular discussions with their students about how to properly use and cite online sources.
- **Virus Protection**
  - Laptops were checked for viruses by Deep Freeze every time they logged back into the school/district system.
  - Teachers were more careful with the use of flash drives because the school had a serious problem with viruses being passed from laptop to laptop last year. Viruses would be shared when students and teachers transported files using flash drives last year.

- **Storing Student Work**
  - Students were not allowed to use their own file storage devices. The school planned a school-wide launch of Web Lockers, an online storage solution for saving student work.
  - Every week students backed up the work saved on their laptops’ hard drives to an external hard drive kept in the TF’s office.

- **Discipline**
  - A laptop could be taken away from a student for 24 hours if it was left unattended or severely damaged. Teachers could set their own policies within their classrooms. Students who had their laptops taken away were still able to use a desktop in the classroom.
  - A laptop was taken away if it was used to bypass the filter and access unauthorized sites (e.g., MySpace).
  - Students who put books in with their laptops had to see the TF.
  - Staff began to recognize the need for common consequences across all classrooms for inappropriate use of the laptop. One school revised their discipline policy over the summer to include a two-tier infraction policy (see Appendix C).

- **Classroom Monitoring/Management Software**
  - Classroom management software was changed from DyKnow to EduPlatform with great success.
  - The district technology office was in charge of filtering content through SonicWall, but the school planned on utilizing their new classroom monitoring/management software (i.e. SchoolView) to have more control of this process.

Focus group data and open-ended survey responses indicated that teachers, administrators, and students agreed that filtering/blocking of websites has been one of their major day-to-day challenges. Filters were blocking not only websites that provided general information (e.g., historical information) but also websites that serve a legitimate educational purpose (e.g., SAS resources). While both teachers and leaders acknowledged that this was an important issue that needed a prompt resolution, students expressed very strong opinions about it. A large number of students noted that the filters/blocks, such as Smart Filter, hindered their learning by blocking most websites, especially when work needed to be done in class. They felt that they were unfairly penalized when they were unable to complete work that required the use of websites being blocked by the school. To circumvent this problem, they either used their own desktops at home, if they had one, or used proxies to access blocked websites.

*Blogs and wikis are blocked; pretty much all Web 2.0 tools are blocked.*

*The filter often makes using laptops impossible. It gives us, as instructors, no flexibility in planning, as we have to have our sites approved weeks ahead of time. Furthermore, it makes student research difficult when anything concerning politics is blocked. Also, I cannot have my students look at any other work produced by other teachers because all personal pages are blocked. Finally, when I attempt to get videos for my students, all streaming media is blocked.*
Our Internet filter blocks everything that is beyond "school websites." Things that could be useful such as video sites, historical investigation sites, and all political sites are blocked. We have no way of getting to these sites for research purposes unless we use ways that are against the rules.

This issue seems to be of critical concern, as it is hindering the pedagogical use of the technology. Schools and LEAs need to find a filtering solution that is flexible enough to allow teachers and students to access important Internet resources.

Leadership
Teachers agreed that the principal and TF had been effective leaders of the 1:1 initiative at their school. Incidentally, results from the surveys indicated that the TF played as important a leadership role for the 1:1 Learning Initiative as the school principal (see Figure 5). Focus group discussions with teachers reiterated this finding at the insistence that this project would not have been possible without the hard work and dedication of the TF.

Figure 5. Percent of ECHS (n = 48) and traditional (n = 51) 1:1 teachers that agree the principal and/or technology facilitator has been an effective leader of the 1:1 initiative.

Teachers at participating schools were asked to identify the three individuals who were the driving forces behind their school's 1:1 Learning Initiative (see Table 4). Both the principal and technology facilitator played key leadership roles for this innovative program at the schools. The district staff and some teachers also provided leadership for the 1:1 projects.

Table 4. Tally of teachers’ open-ended responses to “Who are the individuals who are the driving forces behind your school's 1:1 Initiative?”

<table>
<thead>
<tr>
<th></th>
<th>District Admin</th>
<th>Principal</th>
<th>Assistant Principal</th>
<th>TF</th>
<th>Technician</th>
<th>Teacher</th>
<th>Totals</th>
</tr>
</thead>
<tbody>
<tr>
<td>1:1 Traditional</td>
<td>3</td>
<td>29</td>
<td>6</td>
<td>35</td>
<td>0</td>
<td>7</td>
<td>80</td>
</tr>
<tr>
<td>1:1 ECHS</td>
<td>8</td>
<td>35</td>
<td>4</td>
<td>47</td>
<td>3</td>
<td>9</td>
<td>106</td>
</tr>
<tr>
<td>totals</td>
<td>11</td>
<td>64</td>
<td>10</td>
<td>82</td>
<td>3</td>
<td>16</td>
<td>186</td>
</tr>
</tbody>
</table>

The focus group discussions furthered our understanding of the role of the leader for a 1:1 initiative. One of the focus group questions asked “What do you think are the most important things a school leader can do to support a new 1:1 laptop project in a high school?” Quotes illustrate some of the key findings around leadership for a 1:1 project:
Show the benefits. If people see the benefits, they’ll buy in. If they don’t see the benefits, they’ll see work. Every teacher is overworked and underpaid, just ask them, but if they buy in to it, you’ll get them.

I think a leader needs to understand that this is a very slow process as far as integrating, and not push. We’ve been real fortunate that we haven’t felt really pushed to integrate the laptops, but to take baby steps to make sure that you’re slowly integrating and changing things up, but not just say, “Okay, you have to have this, this, this and this done by this time” or “You have to use it every single day, every time I walk in there I better see,” and there’s been none of that.

I think [the principal] needs to have an understanding of where their school’s going, what the plan is, and what part of that plan makes their school an individual, what makes it different from others, and then lobby for that individuality. A blanket policy is not going to work for a program like this, we just can’t do it, and some of it doesn’t make sense.

A good leader is one who realizes that a computer is just a tool – it doesn’t take the place of an educator in the classroom.

Modeling, because you can’t expect us to grow into this technology thing and do all of this if you’re not at least doing an example of using it yourself, and I am not tech friendly, but since I’ve been here, I don’t have a desktop anymore, I have a laptop, so I’m growing.

I think it’s important for the leader to know if [the teachers] need something to support their classroom, whether it’s software or hardware or whatever, that [the principal] is going to find the means to provide what they need.

Infrastructures/Support Systems Summary: Teacher and administrator responses to survey items about attitudes and beliefs about technology were compared. The comparisons revealed some differences in their attitudes and beliefs about the use of the laptops for teaching and learning for both the ECHS and traditional high school staff. The teachers and administrators share similar beliefs about the general teaching benefits; increased access to up-to-date information and diverse teaching materials and resources; reduction in use of paper-based supplies; and an increased ability to explore topics in greater depth as a result of the 1:1 initiative. However, the administrators seemed to be underestimating the difficulty of classroom management with the laptops and the increase in the teachers’ workload, and overestimating the likelihood that a teacher can cover more material in a 1:1 environment.

Professional Development
During the summer preceding the 2008-2009 school year, teachers reported receiving professional development from several sources to support the laptop initiative. This professional development ranged from very general and not necessarily targeted toward 1:1 computing efforts to very specific and completely targeted toward 1:1 computing efforts.

National Conferences: On the "general" end of the spectrum, four schools sent selected teachers and technology facilitators to the National Educational Computing Conference (NECC) held in San Antonio during July. Attendees benefited from presentations by vendors of products in place at the 1:1 schools (e.g., Promethean boards, E-Chalk), from sessions on 1:1 computing, and from other more general sessions:

Two teachers and myself [technology facilitator] went to the [National Educational Computing Conference] in San Antonio, Texas.... E-Chalk was actually represented there, so we went through some of the experiences with the various vendors that were set up there. We actually also
went to a 1:1 computing seminar, most of us signed up for those... We got some valuable information, some hiccups that individuals had along the way, and how we can learn from those, and we were actually able to get a lot of literature too, to support 1:1 initiatives.

I went and hung out with the Promethean people, because that’s what we’re using, and then the Texas Instruments people, because I teach Math. But then we also went to several of the sessions and came back with lots of ideas about visual learning, and how it’s really neat to have something for the kids to connect with and walk away with. And then there was podcasting.

State Conference: All seven of the 1:1 computing ECHS pilots sent teams to the New Schools Project Summer Institute held in Winston-Salem. Although not entirely focused on 1:1 computing, attendees discussed how several technology-related sessions at this institute benefited their 1:1 computing programs, in addition to the benefits of convening with other schools implementing 1:1 computing:

They had all the 1:1 schools with Frances Bradburn together, so that was good. I think they did a lot of protocol-like things, and then the geo-scavenger hunt, so they did some things together. So it was good to have all early colleges that were 1:1 initiatives together.

What we worked on there was our portfolio that we’ve rolled out with the freshmen. Their portfolio is all online, that was one thing that we decided.... Our idea is by the time our freshmen become upperclassmen, seniors, they’ll be able to use their online stuff that they’ve gotten compiled from their portfolio to help them develop the graduation project. There’s eight pieces to it, and they basically pick each piece. It could come from any class.... We’re actually using an online resource called Epsilen... called a personal learning environment.

We did one day of using the laptops to log on to CSNC, and kind of take a tour of a lot of their career exploration services that they have for students.

Friday Institute Face-to-Face Professional Development: Six schools also sent teachers and technology facilitators to the Leadership Institute sponsored by the Friday Institute's 1:1 Learning Collaborative. This training was customized for 1:1 pilot schools and other schools implementing 1:1 in the state, and included both whole-group presentations and five breakout sessions geared to specific content areas and personnel (i.e. English/Language Arts, Math, Science, Social Studies, and Technology Facilitators). Table 5 presents the overall rating for each session offered at the Leadership Institute.

Table 5. Overall Rating of Friday Institute Summer 2008 1:1 Leadership Institute Professional Development Event (n=91)

<table>
<thead>
<tr>
<th>Session</th>
<th>5 Outstanding</th>
<th>4</th>
<th>3 Average</th>
<th>2</th>
<th>1 Poor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Teaching and Learning in 1:1 Classrooms</td>
<td>17%</td>
<td>68%</td>
<td>13%</td>
<td>2%</td>
<td></td>
</tr>
<tr>
<td>New Literacies and Student Generated Content: Engaging the YouTube Generation</td>
<td>92%</td>
<td>8%</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Harness the Power of the Internet…WISEly</td>
<td>71%</td>
<td>29%</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Using Online Applets in Math Instruction</td>
<td>78%</td>
<td>22%</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Social Studies and Google Earth</td>
<td>36%</td>
<td>27%</td>
<td>18%</td>
<td>9%</td>
<td>9%</td>
</tr>
<tr>
<td>Lessons Learned about Virtual Worlds for Learning: The River City Case Study</td>
<td>52%</td>
<td>33%</td>
<td>14%</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Project-Based Learning</td>
<td>79%</td>
<td>14%</td>
<td>7%</td>
<td>9%</td>
<td>-</td>
</tr>
<tr>
<td>What Works and What Doesn’t: Words of Wisdom from the Trenches</td>
<td>35%</td>
<td>48%</td>
<td>13%</td>
<td>4%</td>
<td>-</td>
</tr>
</tbody>
</table>
Panel B 50% 39% 11% 4%
Cool Tools for Instruction 45% 40% 15% 2%
Toward successful and sustainable Technology Integration: Building a Culture of Shared Leadership 5% 50% 30% 10% 8%
1:1 Computing Initiatives Across the Nation 30% 60% 10%
Lessons from the Maine 1:1 Computing Experience 44% 44% 12% 4%
Empowering Teachers to Be Leaders 14% 43% 36% 7%
Designing Professional Development 40% 40% 20%
Using Online Tools for Professional Development 50% 25% 25%
The Computers are Coming! Managing Change in the Classroom 92% 8%
Technology Infrastructure 60% 40%
Fostering and Sustaining Change 33% 67%
Going Deeper with Math 67% 33%
Universal Design for Learning 33% 67%

We had a content-area-alike breakouts, and then just some general 1:1 individuals that came to speak on the behalf of the initiative.

At the Friday Institute, we had the Google Earth thing.... I really love the Google Earth concept in social studies.... I learned a lot from that and got a lot from that. That was good.

Additionally, the Friday Institute offered two-day workshops offered by faculty at the Friday Institute focusing on content-specific resources and tools. Participants indicated these sessions were beneficial. Table 6 presents the percent of participants agreeing with indications of professional development quality for each session offered at the face-to-face sessions.

Table 6. Percent of Friday Institute Content-Specific Workshop Participants Agreeing with Indicators of Professional Development Quality

<table>
<thead>
<tr>
<th>Item</th>
<th>Technology Facilitators (n = 14)</th>
<th>Science (n = 26)</th>
<th>Social Studies (n = 20)</th>
<th>Math (n = 34)</th>
<th>English (n = 26)</th>
</tr>
</thead>
<tbody>
<tr>
<td>The workshop was of high quality.</td>
<td>92.9%</td>
<td>92.3%</td>
<td>100%</td>
<td>87.9%</td>
<td>100%</td>
</tr>
<tr>
<td>The workshop enhanced my understanding of teaching and learning in a 1:1 environment.</td>
<td>92.9%</td>
<td>84.7%</td>
<td>90%</td>
<td>75.8%</td>
<td>96.1%</td>
</tr>
<tr>
<td>The workshop helped me gain new information and skills.</td>
<td>92.9%</td>
<td>96.2%</td>
<td>100%</td>
<td>84.9%</td>
<td>100%</td>
</tr>
<tr>
<td>The workshop provided me with important resources.</td>
<td>85.7%</td>
<td>96.2%</td>
<td>100%</td>
<td>83.8%</td>
<td>100%</td>
</tr>
</tbody>
</table>
Participants provided positive feedback about their experiences in the content-specific workshop sessions. They indicated that learning how to create wiki, networking with other teachers, and learning new technology tools and resources were the most beneficial parts of the workshop. They reported some difficulty with the amount of information presented in a short time, and participants’ varying levels of technical skills and knowledge. For future face-to-face sessions, participants suggested more opportunities to talk about how to implement 1:1 in their classrooms, opportunities to experiment with new classroom technologies and resources, and dividing sessions by technology skill level.

Although a lot of technology tools and resources were shared, comments by some participants might indicate they had some difficulty translating this new information into a "lesson" format and comprehending how a tool or resource might work in practice; or at least they desired leaving the workshops with a lesson in hand to implement:

[I would like] Discussion of how to implement these things in our classrooms.

[I would like] More lesson plan development.

[I would like] More ways to create lesson plans.

Friday Institute Online Workshops: In addition to the Leadership Institute offered at the Friday Institute, the 1:1 Learning Collaborative also offered three online workshops teachers could take over six weeks during the fall 2008 semester, including sessions on differentiated instruction, best educational resources, and Web 2.0 tools; and, five content-specific, face-to-face workshops (i.e. Technology Facilitators, Science, Social Studies, Math, and English). Participants were complimentary of the lessons:

Very beneficial course. I learned a lot and feel motivated to start using some of the Web 2.0 tools I was introduced to in my classroom.

Came away with tons of resources and am excited to implement my new-found discoveries.

Online workshops offered through the 1:1 Collaborative were also well received as shown in Table 7, particularly the workshop on Web 2.0 technologies.

Table 7. Percent of Friday Institute Online Workshop Participants Agreeing with Indicators of Professional Development Quality

<table>
<thead>
<tr>
<th>Item</th>
<th>Differentiated Instruction (n = 4)</th>
<th>Best Educational Resources (n = 5)</th>
<th>Web 2.0 (n = 5)</th>
</tr>
</thead>
<tbody>
<tr>
<td>The workshop was of high quality.</td>
<td>75%</td>
<td>80%</td>
<td>100%</td>
</tr>
<tr>
<td>Item</td>
<td>Differentiated Instruction (n = 4)</td>
<td>Best Educational Resources (n = 5)</td>
<td>Web 2.0 (n = 5)</td>
</tr>
<tr>
<td>----------------------------------------------------------------------</td>
<td>-----------------------------------</td>
<td>-----------------------------------</td>
<td>----------------</td>
</tr>
<tr>
<td>The workshop enhanced my understanding of teaching and learning in a 1:1 environment.</td>
<td>75%</td>
<td>80%</td>
<td>100%</td>
</tr>
<tr>
<td>The workshop helped me gain new information and skills.</td>
<td>75%</td>
<td>100%</td>
<td>100%</td>
</tr>
<tr>
<td>The workshop provided me with important resources.</td>
<td>50%</td>
<td>100%</td>
<td>100%</td>
</tr>
<tr>
<td>The workshop provided me with useful opportunities to network with colleagues from other schools.</td>
<td>75%</td>
<td>100%</td>
<td>100%</td>
</tr>
<tr>
<td>The workshop met my expectations.</td>
<td>75%</td>
<td>80%</td>
<td>100%</td>
</tr>
<tr>
<td>Overall, I feel the workshop was beneficial to me.</td>
<td>75%</td>
<td>100%</td>
<td>100%</td>
</tr>
</tbody>
</table>

Online workshop participants commented that the most beneficial aspect to participation was learning about new tools, new resources, and discussing technology topics with peers.

_I enjoyed the feedback from the facilitator as well as fellow participants. A great way to meet other educators!

In fact, several participants desired even more discussion and communication with both online workshop facilitators and peers that fell behind in places:

_Often times, feedback is what motivates me to stay on track in an online professional development course. I think that the lack of this kind of teacher/student interaction resulted in a lot of students not participating.

_Please provide more constructive/critical feedback to participant performance.

_I didn’t think many people contributed so it was sometimes difficult to comment on things in discussion.

_Many people were late in participating each week.

_We need a collaborative wiki to share our resources.

Participants were complimentary of specific facilitator qualities such as summarizing material for the learners, pacing students, prompting students with questions, modeling technology use, and providing feedback on assignments:

_Our facilitator was very positive and kind when responding to our forum posts or to completed assignments.

_She made VoiceThread video clips to recap or highlight the previous week.

_The instructor kept us on track and modeled the technology we were supposed to be exploring.

_I liked the fact that our facilitator was testing out the web-based tools along with us.
Some online workshop participants hinted that too much information was presented in a course at one time, making content difficult to process:

My concern would be number of different topics addressed each week. Certainly for the different levels of technology expertise in the course, this may have made it more difficult for those of us who might be considered intermediates in terms of knowledge.

One teacher recommended splitting online workshops into short courses of two weeks in duration, focusing more heavily on just one or two tools or resources at a time:

I think that one approach would be to really have a series of short two-week courses focusing on individual aspects of what we did over six weeks. If I have two weeks to work on RSS feeds then maybe I would have a better understanding of it. The same could be said for Blogs and Wikis. Maybe another course could be all of the Google applications.

Local Professional Development: All of the 1:1 computing pilot schools provided professional development on their own campuses or in their districts over the summer and during the school year (for a complete list see Appendix D). Teachers at the seven 1:1 ECHS were offered a total of 239 hours of professional development by their school or district. Some of the most common topics included classroom monitoring software such as E-Chalk and DyKnow; course management including Moodle and Eduplatform; the implementation of techniques learned at outside workshops and conferences; gaming technology such as Second Life and Study Island; tools such as VoiceThread, podcasting, and United Streaming; and Web 2.0 tools including wikis, blogs, and social bookmarking. Teachers at the 1:1 traditional high school were offered a total of 195 hours of professional development by their school or district on topics such as Microsoft Office; SmartBoards; website design; assessment tools such as clickers or ClassScapes; and photo editing. Like the 1:1 ECHS, the traditional high school held professional development regarding classroom management and monitoring software.

We did some training there, exclusively with DyKnow, logging in, a management piece, how you can use DyKnow for instruction as well, so we had that.

My student technology team came in for three sessions over the summer in terms of training for them.

Outside of formal professional development planned and implemented by external groups, it should be noted that teachers also engaged in self-planning for use of their laptops over the summer months. This planning was formalized at one school where specific teachers were paid over a period of three weeks to develop lessons incorporating laptops. It was suggested these lessons could be shared to provide a starting point for other teachers when school reconvened:

We spent two and a half to three weeks working over the summer [paid for 96 hours of planning], and one of our tasks was to create some technology lesson plans for every content area, so that when the whole staff came back we would have several technology-based lessons to give each content area. And I think that really helped us as the tech team kind of get a better feel for the technology, kind of get some goals for our school for the year. But then hopefully it kind of gave some of the teachers a place to start.... It was a reflection time and also a planning time for us to start the year back.

Two schools suggested self-planning was also less formal, with teachers spending time in the summer practicing with hardware and software, and identifying teaching resources:
Several of us took these things home and worked on them for additional hours for free. That time was invaluable. We practiced with a flipcam, we practiced with Audacity software, we spent hours researching resources and just practicing the kinds of things that we want the kids to do.

Professional Development Summary: In sum, while a majority of respondents felt that the professional development opportunities they participated in were generally useful, future professional development should acknowledge that teachers are at different stages of adapting to 1:1 environments, and have differing experience with instructional technology. Further, professional development should be targeted toward not just how to use particular tools, but how to incorporate them effectively for pedagogical use. Finally, professional development should be targeted at different content areas. For example, mathematics teachers were less enthusiastic about some professional development than others. It may be the case that professional development that is focused on specific content areas might be more useful in the long run. And as mentioned before, teachers felt the need for more “just in time” professional development through on-site technology facilitators as an on-going process.

Evaluation Question 2: What are teacher and student technology attitudes and skills?

Technology Attitudes and Beliefs

Teacher Attitudes and Beliefs about Technology

There were no significant differences between ECHS teachers at the 1:1 and non-1:1 schools in regards to agreement related to attitudes and beliefs about technology except for a belief that using laptops “increased my work load” (see Figure 6). Many studies have shown a drop in positive attitudes toward new technologies after an initial rise because the novelty has worn off; teachers then deal with the reality of having to redesign most of their lessons and classroom management approaches (Fullan, 2001). However, we do not see this pattern in our data. Overall, attitudes remained generally positive about the impact of laptops in the classroom.

Figure 6. Percent of 1:1 ($n = 57$) and Non-1:1 ($n = 42$) ECHS teachers indicating agreement with various statements about their attitudes and beliefs regarding Teaching & Laptops/Computers.

Note. *This indicates that there was a statistically significant difference between groups ($p < .05$).

Significant differences were found for the traditional teachers at the 1:1 and non-1:1 schools in regards to agreement related to attitudes and beliefs about technology related to teaching and laptops – including ability to individualize curriculum, provide up-to-date information to students, effectively manage the
classroom, and an increase in teachers’ workload (see Figure 7). These results indicate that the teachers might have benefited from professional development on using the laptops as a tool to individualize curriculum to meet student needs, classroom management strategies, and strategies for minimizing workload.

Figure 7. Percent of 1:1 (n = 58) and Non-1:1 (n = 69) traditional high school teachers indicating agreement with various statements about their attitudes and beliefs regarding Teaching & Laptops/Computers.

Note. *This indicates that there was a statistically significant difference between groups (p < .05).

Teachers at the 1:1 ECHS reported more agreement than teachers at the non-1:1 ECHS that using the laptops in the classrooms allowed them to cover more information, require less paper supplies, and explore subject in greater depth (see Figure 8). The 1:1 teachers also indicated that they do not need more direct technical support – their TPs and technicians are providing the technical and instructional support the teachers need.

Figure 8. Percent of 1:1 (n = 57) and Non-1:1 (n = 42) ECHS teachers indicating agreement with various statements about their attitudes and beliefs regarding Teaching & Laptops/Computers.
Overall, significant differences were found for the ECHS teachers’ perceptions of the learning benefits of laptops (see Figure 8). The 1:1 teachers agreed that their students were more actively involved in their learning, more productive, more organized, and more engaged.

*Figure 9.* Percent of 1:1 \( (n = 56) \) and Non-1:1 \( (n = 42) \) ECHS teachers indicating agreement with various statements about their attitudes and beliefs regarding Learning & Laptops/Computers.

The teachers at the 1:1 traditional school were slightly less positive about the learning benefits of laptops, although the 1:1 teachers agreed their students were more actively involved in their learning and more engaged (see Figure 10).

*Figure 10.* Percent of 1:1 \( (n = 58) \) and Non-1:1 \( (n = 69) \) traditional high school teachers indicating agreement with various statements about their attitudes and beliefs regarding Learning &
Laptops/Computers.

Note. *This indicates that there was a statistically significant difference between groups (p < .05).

In sum, attitudes toward instructional technology were positive, although it was perceived to increase teacher workload and classroom management issues. Teachers did see the technology as increasing student engagement and encouraging more active learning.

**Student Attitudes/Beliefs about Technology**

There were no significant differences between ECHS students at the 1:1 and non-1:1 schools (see Figure 11) in regards to agreement related to attitudes and beliefs about technology except for beliefs that “Now that I have my laptop I interact with my teachers more,” “The quality of my work has improved with the use of my laptop,” and “The more frequently teachers use technology, the more I enjoy school.” Many studies have shown a drop in positive attitudes toward new technologies after an initial rise because the novelty has worn off. Students then deal with the reality of having to be responsible for their laptop and with higher expectations for their work (Rogers, 2003). Overall, student attitudes remained generally positive about the impact of laptops in the classroom.

**Figure 11.** Percent of 1:1 (n = 893) and Non-1:1 (n = 665) ECHS students reporting agreement with various statements about their attitudes and beliefs regarding technology.
Generally, a higher percentage of the ECHS 1:1 teachers reported greater technology skills this academic year compared to last year for skills such as creating websites, working with databases and spreadsheets, using digital images and video, social networking, blogging, and podcasting (see Figure 12-13). These results are interesting because sometimes teachers have a decrease in perception of level of technology skills once they have unlimited access to a lot of technology in the classroom, but we do not observe this pattern in our data.

Figure 12. Percent of 1:1 ECHS teachers reporting the ability to independently do or teach others various technology skills in April 2008 (T1, n = 77) and September 2008 (T2, n = 54).
Survey results showed an increase in the percentage of traditional 1:1 teachers reporting greater technology skills when comparing this academic year to last year, except for creating databases (see Figure 14).

Survey results showed an increase in the percentage of traditional 1:1 teachers reporting greater technology skills when comparing this academic year to last year, except for creating blogs (see Figure 15).

Note. *This indicates that there was a statistically significant difference between groups (p < .05).
Student Technology Knowledge/Skills

The 1:1 ECHS students’ perceptions of their technology skills had not changed in the past few months. Generally, students were most confident in their ability to create graphs, work with digital images, and create multimedia presentations. Students might be interested to learn more about creating web pages and graphic designs (see Figure 16).

Figure 16. Percent of 1:1 ECHS students reporting the ability to independently do or teach others various technology skills in April 2008 (T1, n = 589) and September 2008 (T2, n = 739).

The 1:1 traditional high school students’ perceptions of their technology skills had not changed in the past few months (see Figure 17). Generally, students were most confident in their ability to create spreadsheets, record sounds, and create multimedia presentations. Students might be interested to learn more about creating web pages and graphic designs.
Figure 17. Percent of 1:1 traditional high school students reporting the ability to independently do or teach others various technology skills in April 2008 (T1, n = 381) and September 2008 (T2, n = 628).

Note. *This indicates that there was a statistically significant difference between groups (p < .05).

The 1:1 ECHS students’ perceptions of their technology skills related to Web 2.0 activities had not changed in the past few months (see Figure 18). Generally, students were most confident in their ability to create graphs and create and maintain a blog. Students might be interested to learn more about creating podcasts.

Figure 18. Percent of 1:1 ECHS students reporting the ability to independently do or teach others various Web 2.0 skills in April 2008 (T1, n = 752) and September 2008 (T2, n = 870).

Note. *This indicates that there was a statistically significant difference between groups (p < .05).

The 1:1 traditional high school students’ perceptions of their technology skills related to Web 2.0 activities had not changed in the past few months (see Figure 19). Generally, students were most confident in their ability to create graphs and create and maintain a blog. Students might be interested in learning more about creating podcasts.
In the open-ended survey responses, some teachers and students acknowledged that teachers’ as well as students’ technology skills were not as strong as they should have been. Some teachers identified their lack of technical knowledge and experience with computers as the barrier; others considered their lack of ideas on how to integrate computers as the constraint. Students concurred with this assessment of the teachers’ skills by pointing out that some of their teachers were not comfortable using the laptops, did not know how to use certain software (e.g., DyKnow), or were unable to integrate the laptop into their teaching.

*In many cases, I still do not feel adequate in my preparation or skill level. (Teacher, interview)*

*Teachers do not know how to use the technology and integrate it in the classrooms. (Student, survey)*

While most students expressed that the laptops were helping them to do better, and some even wanted more opportunities for learning using the laptops, some students felt that they did not possess the necessary technical skills to use them, nor were they receiving enough training on their use. Among this group were those who felt that they did not possess the typing skills to keep up with class activities.

*Summary of Technology Knowledge/Skills: In sum, teachers generally had positive attitudes about the impact of technology in the classroom. These results were not generally different from teachers in non-1:1 schools. Most interestingly, teachers indicated that they felt technology improved student engagement and active learning possibilities, while at the same time dramatically increasing teacher workload and increasing issues relating to monitoring and managing classroom behavior.*

Teachers also showed significant growth in confidence over time concerning their technology skills. They tended to feel least confident in using new technologies such as wikis and blogs.

Students also showed strong confidence in their technology abilities, but failed to show change over time. Students seemed most confident with their abilities in basic skills such as using a spreadsheet, creating a database, manipulating digital images, and creating multimedia presentations. Interestingly, students seemed least confident in their abilities to create a web page or work with blogs or wikis.
Evaluation Question 3: How have teachers’ instructional practices changed over time?

Technology Use

Teacher Technology Use

Participating 1:1 teachers reported using the laptops more frequently this year compared to last year. ECHS teachers reported a significant increase in daily use of the laptops for planning activities such as producing homework, assessing student work, managing information, communicating with families, and collecting performance data (see Figure 20).

*Figure 20.* Percent of 1:1 ECHS teachers indicating daily use of technology for various planning activities in April 2008 (T1, n = 78) and September 2008 (T2, n = 56).

Survey results showed a slight increase in the percentage of traditional 1:1 teachers reporting daily use of the laptops for planning when comparing this academic year to last year, except for communication with parents (see Figure 21). Teachers might have communicated with parents more often at the beginning of the laptop project in order to get information about the project out to families.

*Figure 21.* Percent of 1:1 traditional high school teachers indicating daily use of technology for various planning activities in April 2008 (T1, n = 46) and September 2008 (T2, n = 55).

Note. *This indicates that there was a statistically significant difference between groups (p < .05).*
Participating 1:1 teachers reported using the laptops for instructional activities more frequently this year compared to last year (see Figure 22). ECHS teachers reported a significant increase in the daily use of laptops to present content, give online quizzes, present steps in an activity, take virtual field trips, and use instructional websites or blogs. Teachers still reported using the laptops most often to present content to students. These results suggest that teachers need information about instructional digital resources such as labs and guest speakers.

Figure 22. Percent of 1:1 ECHS teachers indicating daily use of technology for various instructional activities in April 2008 (T1, n = 78) and September 2008 (T2, n = 56).
Survey results showed a slight increase in the percentage of traditional 1:1 teachers reporting daily use of the laptops for planning when comparing this academic year to last year for online resources, media presentations, and instructional websites/blogs (see Figure 23). Teachers still reported using the laptops most often to present content to students. These results suggest that teachers need information about instructional digital resources such as online quizzes, labs, virtual field trips, and online guest speakers via videoconferencing.

*Figure 23. Percent of 1:1 traditional high school teachers indicating daily use of technology for various instructional activities in April 2008 (T1, n = 46) and September 2008 (T2, n = 55).*

![Figure 23](image_url)

Note. *This indicates that there was a statistically significant difference between groups (p < .05).*

**Student Technology Use**

The 1:1 ECHS students reported significantly more daily technology use than the comparison schools (see Figure 24). Students reported the most use in their Language Arts and Science classes.

*Figure 24. Percent of 1:1 (n = 611) and Non-1:1 ECHS (n = 448) students reporting daily use of laptops/computers in various classes.*

![Figure 24](image_url)

Note. *This indicates that there was a statistically significant difference between groups (p < .05).*
The 1:1 traditional high school students reported significantly more daily technology use than the comparison school (see Figure 25). Students reported the most use in their Social Studies classes. Elective courses seemed to require use of their laptops as often as their core content area courses. Foreign language teachers were interested and engaged in using laptops for teaching and learning but their classrooms are located in mobile units/trailers which do not have internet access per district policy against wireless access points in temporary classrooms.

Figure 25. Percent of 1:1 \( (n = 550) \) and Non-1:1 \( (n = 695) \) traditional high school students reporting daily use of laptops/computers in various classes.

Note. *This indicates that there was a statistically significant difference between groups \((p < .05)\).

Survey results indicated a change in the use of technology to support common instructional practices from last year to this year (see Figure 26). Data from the classroom visits supported the aforementioned results. Instances of observed use of technology for various instructional activities increased when comparing last year’s visit to this year’s visit.

Figure 26. Percent of 1:1 high school courses that teachers were observed doing various activities using technology in April 2008 (T1, \( n = 46 \)) and September 2008 (T2, \( n = 41 \)).

Note. *This indicates that there was a statistically significant difference between groups \((p < .05)\).
In the open-ended survey responses, students reported a broad range in the amount of laptop use in their classes. More specifically, they noted wide variation in the frequency with which teachers used the laptops for class. Some teachers used them every day, whereas other teachers barely used the laptops for instructional purposes. Various students noted that while some of the teachers appreciated the technical know-how of their students and relied upon them for assistance, other teachers seemed uncomfortable with and unnerved by the role reversal.

Planning and Managing Instruction
Teachers reported keeping an open mind and enjoying an increase in confidence with using online resources and other new technologies. Teachers indicated they are pushed and challenged in a positive way to create excellent lessons, because they are “on the cutting edge” of teaching (see Appendix E for an description of example lessons). They tried to make lessons that encompass different learning styles such as auditory, visual, and kinesthetic.

- Collaboration and Shared Teacher Workspace - Teachers do a great deal of lesson planning individually since their day does not allow for much collaborative planning time. Google Talk and Google Docs help to keep teachers connected for planning purposes as well as for contact on campus. Teachers would like to have a common storage space for all of their 1:1 lessons that incorporates a quick and easy way to upload their lessons. Teachers are finding that creating generic rubrics to be shared across disciplines is beneficial. A brochure, for example, may be created using the same software and basic formatting for different classes. Students enjoy creating digital narratives, and they prefer the built-in video camera over the traditional digital camera. Teachers have found that virtual tours are excellent classroom resources.

- Filtering – Teachers, administrators, and students agreed that the filtering/blocking of websites has been the major challenge. Filters have been blocking not only websites that provide general information (e.g., historical information) but also websites that serve a legitimate educational purpose (e.g., SAS software). Teachers visited workshops such as those at the Friday Institute that involved excellent sites, which then turned out to be filtered within their districts. Students also expressed very strong opinions about filtering. A large number of them noted that the filters/blocks such as Smart Filter hindered their learning by blocking most websites, especially when work needed to be done in class. They felt that they were unfairly penalized when they were unable to complete work that required the use of websites being blocked by the school.

  Blogs and wikis are blocked; pretty much all Web 2.0 tools are blocked.

  The filter often makes using laptops impossible. It gives us, as instructors, no flexibility in planning, as we have to have our sites approved weeks ahead of time. Furthermore, it makes student research difficult when anything concerning politics is blocked. When I attempt to get videos for my students all streaming media is blocked. Combined, about 3/4 or more of the Internet is filtered for content, this has destroyed morale for laptops among staff and students.

  Our Internet filter blocks everything that is beyond "school websites." Things that could be useful such as video sites, historical investigation sites, and all political sites are blocked. We have no way of getting to these sites for research purposes unless we use ways that are against the rules.

- Reflection - Although implementing lessons for 1:1 classroom environments can be a difficult adjustment, teachers reported feeling much less stress in comparison to last year, their first year implementing the 1:1 initiative. One TF emphasized the importance of reflection for teachers:
I think that in some ways [reflecting] made it a little easier for the teachers, simply because they are more aware that they are doing a lot of these things, and it’s just taking it a step further, I think it made it a little easier for them, just increased their comfort level.

- Course Management System – Teachers expressed the need for a course management system such as Moodle or Blackboard. Students often allowed their electronic assignments to pile up until the end of the term. On a positive note, one teacher mentioned the joy of not being accused of losing papers anymore due to the time and date stamp on assignments delivered through drop boxes and emails. Lastly, some teachers believed they would include more electronic assessment if they had a quality course management system such as Moodle or Blackboard.

**Use of Technology for Assessment**

Most teachers utilized some form of online or electronic assessment either through email, Curriculum Pathways, AVID, Activevote (similar to clickers), ClassScapes, online quizzes, Glinko.com, OneNote, games, Promethean boards, live chat, Study Island, blogs, electronic rubrics, and online textbook resources. Teachers especially liked being able to project anonymous, immediate assessments through polling during class to discover if students comprehended the material. For group projects, one teacher had success using electronic peer evaluation as a part of assessment. Using the laptops for assessment saves time when compared to traditional grading; one teacher, however, mentioned the time-consuming nature of having to open each file to grade writing. Using laptops for assessment helps teachers create projects that synthesize material across disciplines:

One of the things that this technology allows us to do is give them assessments like this, this is something that’s interdisciplinary; they have had to produce a brochure meeting certain science criteria and pulling in language arts and 21st century skills; these that I’m grading are assessments of The Minister’s Black Veil, in which I pulled in the National Gallery of Art; they had to choose four scenes from the book, do certain things with them, and illustrate them with a great American artist; so it let us really give assessments that not only ask that they demonstrate that they have read science textbooks or literature textbooks, but makes them synthesize.

However, some teachers were concerned with the use of laptops for assessment because EOCs are not electronic, and they wanted to be sure to provide adequate practice for students using paper-based assessments. Teachers also mentioned the need to lock the Internet or OneNote during online or electronic assessment. Students are easily able to Google answers if they have access to the Internet while taking an online quiz or test. A few teachers questioned whether or not students’ ways of learning differ when they are assessed and taught online as opposed to via paper-based activities and assessment:

I’m interested to find out is information processed differently through this medium than it is in paper, and I’m wondering, and I guess I’ll get feedback this year when I get EOC results, because I switched to doing all of this stuff online a year or so ago, and my EOC scores have fallen.

**Evaluation Question 4: How have student learning and achievement in core academic subjects changed over time?**

**Student Learning Outcomes**

*Attendance* - Analysis of attendance data showed overall high rates of attendance at each of the 1:1 pilot high schools and comparison schools for the past three years (see Table 8).

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>ECHS1</td>
<td>99%</td>
<td>99%</td>
<td>98%</td>
<td>ECHS8</td>
<td>94%</td>
<td>99%</td>
<td>97%</td>
</tr>
<tr>
<td>ECHS2</td>
<td>99%</td>
<td>97%</td>
<td>98%</td>
<td>ECHS9</td>
<td>99%</td>
<td>98%</td>
<td>96%</td>
</tr>
<tr>
<td>ECHS3</td>
<td>96%</td>
<td>96%</td>
<td>95%</td>
<td>ECHS10</td>
<td>98%</td>
<td>97%</td>
<td>97%</td>
</tr>
<tr>
<td>ECHS4</td>
<td>98%</td>
<td>98%</td>
<td>97%</td>
<td>ECHS11</td>
<td>97%</td>
<td>98%</td>
<td>96%</td>
</tr>
<tr>
<td>ECHS5</td>
<td>99%</td>
<td>98%</td>
<td>99%</td>
<td>ECHS12</td>
<td>NA</td>
<td>96%</td>
<td>98%</td>
</tr>
<tr>
<td>ECHS6</td>
<td>98%</td>
<td>97%</td>
<td>98%</td>
<td>ECHS13</td>
<td>97%</td>
<td>99%</td>
<td>99%</td>
</tr>
<tr>
<td>ECHS7</td>
<td>95%</td>
<td>98%</td>
<td>98%</td>
<td>ECHS14</td>
<td>96%</td>
<td>98%</td>
<td>96%</td>
</tr>
<tr>
<td>Trad HS1</td>
<td>94%</td>
<td>95%</td>
<td>94%</td>
<td>Trad HS2</td>
<td>96%</td>
<td>96%</td>
<td>96%</td>
</tr>
</tbody>
</table>

Early Withdrawal
As shown in Figure 27, three 1:1 ECHS (1, 5, and 6) reported no withdrawals in October 2006, 2007, or 2008. Three 1:1 ECHS (2, 4, and 7) showed a small decrease in the percentage of withdrawals. One 1:1 ECHS (3) showed a slight increase in the number of withdrawals in October 2008. ECHS have a very low percentage of students who withdrawal from school, and any significant reduction due to the 1:1 learning initiative is highly improbable.

The 1:1 traditional high school experienced greater fluctuation in the percentage of student withdrawals in the month of October over the past four years. Analysis of early withdrawal data for the 1:1 pilot high schools revealed a reduction from 3.18% to 0.88% the first year the laptops were introduced. However, this trend began to rebound in the second year of implementation up to 1.47.

Figure 27. Percent of 1:1 ECHS and 1:1 traditional high school student population who withdrew from school without plans to return during October of 2005, 2006, 2007, and 2008.
Note. Withdrawal data was not included for participating 1:1 ECHS prior to October 2006 because participating schools did not start the full Early College program until the 2006-2007 academic year.

**Student Engagement**

Survey results indicated that staff at the 1:1 schools believed the use of the laptops for teaching and learning increased student engagement. Data from the classroom visits supported those results (see Figure 28). There was an increase in the frequency of observations in which all the students in the classroom showed a positive indicator of engagement such as sustained behavioral involvement, positive emotional tone, and exertion of effort and concentration.

*Figure 28.* Percent of 1:1 high school courses observed in which 100% of students showed positive student engagement in April 2008 (T1, n = 46) and September 2008 (T2, n = 41).
In the open-ended survey responses, some students, teachers, and administrators, indicated that staying on task could be a significant challenge for some students in a 1:1 program. Teachers felt that the computer sometimes provides a distraction for some students and therefore constant monitoring of students is necessary, and several students agreed. They recognized that the computer offers so many options such as Internet browsing, chatting tools, and online gaming, which can easily provide distraction during class.

_The laptop provides minor distraction if the teacher does not have the class actively engaged in an activity involving or specifically prohibiting laptop use._ (Student, survey)

**Student 21st Century Skills**
Generally, most ECHS students agreed that laptops supported their development of 21st century skills. A significant number of 1:1 ECHS students, compared to non-1:1 students, agreed with the following statements results (see Figure 29):

- Use of a laptop/computer at school teaches me life and career skills (e.g., self-direction, social skills, responsibility).
- Use of a laptop/computer at school teaches me learning and innovation skills (e.g., creativity, critical thinking, problem solving).
- Use of a laptop/computer at school has developed my civic literacy by informing me of current events, ethical practices, and the roles of governments.
- Use of a laptop/computer at school supports group collaboration (e.g., peer groups, group projects, discussion boards, wikis, web conferencing).

**Figure 29.** Percent of 1:1 (n = 869) and Non-1:1 (n = 656) ECHS students reporting agreement with various statements about their development of 21st century skills.

![Bar chart showing the percent of 1:1 and Non-1:1 ECHS students reporting agreement with various statements about their development of 21st century skills.]

Note. *This indicates that there was a statistically significant difference between groups (p < .05).*
A higher number of 1:1 teachers reported that their students are using technology more frequently for 21st century learning this year compared to last school year (see Figure 30). Some of the most interesting findings were that students were using their laptops every day to analyze information, create new information, assess their learning, and submit assignments electronically. Students were still using laptops most often to seek information.

*Figure 30. Percent of 1:1 ECHS teachers indicating students’ daily use of technology for various activities in April 2008 (T1, n = 73) and September 2008 (T2, n = 54).*

Survey results for the traditional high school are mixed (see Figure 31). This academic year, compared to last year, the percentage of traditional 1:1 teachers who reported students’ daily use of laptops increased for seeking and collecting information, assessing student learning, and submitting assignments electronically. However, compared to last year, the percentage of traditional 1:1 teachers who reported students’ daily use of laptops decreased for analyzing, integrating, and creating new information. Students used the laptops most often to seek information.

*Figure 31. Percent of 1:1 traditional high school teachers indicating students’ daily use of technology for various activities in April 2008 (T1, n = 46) and September 2008 (T2, n = 53).*
This year, significantly more 1:1 ECHS students reported using technology daily for various learning activities compared to last academic year (see Figure 32). Some of the most interesting findings were the increases in daily use of the laptops to analyze information, integrate new ideas with existing information, assess their learning, and submit assignments electronically. Students still used the laptops most often to seek information.

*Figure 32.* Percent of 1:1 ECHS students reporting daily use of laptops/computers in various learning activities in April 2008 (T1, n = 544) and September 2008 (T2, n = 703).
This year, significantly more 1:1 traditional high school students reported using technology daily for various learning activities compared to last academic year (see Figure 33). Some of the most interesting findings are the increases in daily use of the laptops to plan class activities, assess their learning, and submit assignments electronically. Students still used the laptops most often to seek information.

Figure 33. Percent of 1:1 traditional high school students reporting daily use of laptops/computers in various learning activities in April 2008 (T1, n = 451) and September 2008 (T2, n = 675).

Note. *This indicates that there was a statistically significant difference between groups (p < .05).
When student and teacher survey results were compared, students self-reported much higher frequencies of daily use than their teachers (see Figure 34-35).

*Figure 34.* Percent of 1:1 ECHS teachers (n = 54) indicating students’ daily use of various activities as well as students’ (n = 884) self-reported daily use of corresponding activities.

*Note. *This indicates that there was a statistically significant difference between groups (p < .05).*

*Figure 35.* Percent of 1:1 traditional high school teachers (n = 53) indicating students’ daily use of various activities as well as students’ (n = 875) self-reported daily use of corresponding activities.
Note. *This indicates that there was a statistically significant difference between groups (p < .05).

Survey results indicated that staff and students at the 1:1 schools believed the use of laptops for teaching and learning supported student development of 21st century learning skills. Data from the classroom visits supported those results (see Figure 36-37). There was an increase in the frequency of observations in which teachers and students were using the laptops for 21st century learning skills such as communication (e.g., document preparation, email, presentation, web development), information processing (e.g., data manipulation, writing, data tables), research (e.g., collecting information or data), and group productivity/cooperative learning (e.g., collaboration, planning, document sharing).

**Figure 36.** Percent of 1:1 high school courses observed in which teachers were performing various activities using technology in April 2008 (T1, n = 46) and September 2008 (T2, n = 41).

Note. *This indicates that there was a statistically significant difference between groups (p < .05).

**Figure 37.** Percent of 1:1 high school courses observed in which students were performing various activities using technology in April 2008 (T1, n = 46) and September 2008 (T2, n = 41).
Challenges and Recommendations

The Friday Institute evaluation team conducted site visits that included focus groups with 74 teachers and administrators at the eight participating pilot 1:1 schools. The focus group questions addressed the requirements necessary for a successful 1:1 program in the areas of leadership, technical support, professional development experiences, lesson planning, and the use of technology for assessment, as well as challenges and lessons learned. Open-ended survey items asked 1:1 administrators, teachers, and students about the biggest challenges to using their laptop for teaching and learning. The major findings related to challenges and recommendations are summarized in the following section.

Professional Development
Participants provided positive feedback about their experiences in the 1:1-focused professional development sessions. For future sessions, participants suggested more opportunities to talk about how to implement 1:1 in their classrooms, opportunities to experiment with new classroom technologies and resources, and dividing sessions by technology skill level.

Additional recommendations related to specific topics that could be addressed through future professional development sessions are organized by type of participant:

- Classroom teachers: best practices on content-specific, classroom applications of digital resources most commonly used at the 1:1 pilot schools (see Appendix B); sharing lesson plans; managing student work (collecting, grading, returning, etc.); interactive white boards and laptops; laptops and classroom assessment; copyright; CIPA compliance; and graduation project
- School administrators (administrators, TFs): discipline issues; student tech team models; role of the TF; storing computers, computer bags, etc.; North Carolina Virtual Public School and Learn and Earn
Online opportunities for students; sustainability; the change process; leading an innovation; and building staff buy-in

- District staff (district technology directors, curriculum specialists, superintendents): description and purpose of a 1:1 project; determining school readiness for a 1:1 project; role of the principal and TF at a 1:1 school; district-level policies (blocked sites, deep freeze, teacher requests to unblock sites, saving student work, student email addresses); reimaging and storage over the summer; and FERPA and HIPPA compliance

Policy/procedures
One of the biggest lessons learned is that policies are actually set at the district level but have a big effect on the day-to-day activities of the teachers and students at 1:1 high schools.

- Virus Protection - The first lesson is the importance of routing everything through the district server, which prevents easy access to inappropriate materials on the Internet, and protects student and teacher machines from infection by most viruses.
- Filtering - Additionally, some filtering policies prevent the effective classroom use of Web 2.0 tools such as blogs and wikis. There should be a process in place for teachers to be able to request immediate access to websites and resources, so class time is not lost awaiting approval.
- Saving Student Work - Finally, districts need to consider putting new policies and server resources in place to provide a protected space for students to save work. Students saving work on pin drives or regularly backing up work to external hard drives have been the short-term solutions put in place by these smaller high schools. In one school, there was a reoccurring problem with laptops being infected with viruses because of student use of pin drives to store their work. Such efforts are not realistic long-term solutions for large-scale implementation of a 1:1 project.

Infrastructure/Tools
According to survey results and focus group data, viruses, laptop performance, battery power, laptop bags, and laptop storage pose some challenges in the 1:1 pilot programs.

- Battery-Life - Students identified battery power as a major challenge, noting that laptop batteries ran out of power very quickly. Classrooms need to be equipped with accessible electrical outlets so students can charge their laptops during class, and schools should consider purchasing additional batteries or longer-lasting batteries.
- Storage – One issue often brought up by students was the fact that in addition to their backpack (and purse, gym bag, lunch, etc.) they had to carry a separate bag for the laptop. Teachers and administrators expressed concern that a single bag for both laptop and books results in broken laptop screens because of the pressure on the screens from the weight of the books. One school has had some success with a very slim carrying case for the laptops because nothing else fits in the bag with the computer. Other schools have looked into the new hard-shells for laptops, but found them to be cost-prohibitive at the time. Another challenge identified was the lack of an area to safely store the laptops in the schools while they were not being used. One solution to this issue has been the placement of special shelves in common areas in some of the schools to provide a safe place for the laptops during lunch.
- Student Access - According to teachers and students, another challenge was that not all students actually had a laptop with them every day. Some students may not have a laptop because a) their family declined to receive a laptop by not paying the laptop fee, b) they forgot to bring their laptop to class when it was required, or c) their laptop was being repaired. This is particularly inconvenient for teachers since they then had to prepare two lesson plans, one for the group with laptops and one for the group without. Some teachers mentioned that while their school loaned some laptops to students, the number of “loaners” was not sufficient to cover all students who did not bring a computer to class. In fact, the traditional high school indicated that at one point, 150
students did not have access to their laptops due to technical issues. One district recommended having at least 10% additional laptops on hand to serve as “loaners” to teachers and students.

- **Tablets vs. Laptops** - Adoption seems to come more rapidly with tablets, especially from the teaching community because a large portion of the teaching community still prefers to hand-write instead of type. It has been an easier transition, especially for math and science teachers, because writing mathematic equations and scientific notation is much faster than typing. Of course, the major concern with tablets is durability, especially of the styluses and screen latches. Two of the pilot schools selected tablets for their 1:1 learning initiative. Further information from these schools is needed related to the use of tablets versus laptops in schools.

- **Classroom Management and Monitoring Software** - To monitor students’ activities on the laptops, many schools elected to use a monitoring software called DyKnow, but most users have found the software too cumbersome and plagued with deficiencies. This classroom management software package was simply not capable of meeting the needs of teachers in classrooms. Much was promised (but not delivered) related to the capacity of the software to handle the volume of laptops required for a school-wide 1:1 implementation. The software simply was not developed to monitor 30 different laptops at a time and up to 200 different laptops over the course of a single school day. Only one of the ECHS has found some success with this software, all of the other pilot schools either continue their struggle with it or have decided to move to a different software package such as Eduplatform or SchoolView. The lesson learned here is to make sure the technical support, professional development, server capacity, and overall package for classroom monitoring software can meet the capacity needs of the school. Additional information is needed related to whether schools/districts should even invest in monitoring software and best practices for use.

**Instructional Support Staff**

- **Role of the Technology Facilitator** - The major concern expressed by technology facilitators is their lack of time - spending too much time providing tech support and not enough time integrating technology into the curriculum. According to the IMPACT Model Guidelines, TFs should spend approximately 50% of their time on information access and delivery activities, 42% on supporting teaching and learning activities, and just 8% of their time on program administration (Public Schools of North Carolina, 2005). Training should be provided to school administrators, teachers, and TFs to explore these IMPACT guidelines and other best practices for the role of a TF in a successful school-level 1:1 initiative.

- **A New Model for the TF** - One school took a unique approach to finding a TF for their school. Classroom teachers in each of the four content areas volunteered to act as the collective TF for a small stipend. They are responsible for planning new lessons that incorporate the laptops, identifying and sharing content-specific digital tools and resources, minor troubleshooting, and facilitating a monthly technology meeting with the teachers. At present, this unique approach seems to be working for this particular school. The teachers report they appreciate having support available from a fellow classroom teacher in their content area. They also like having more than one person they can go to with questions and for help. Some experts are concerned this model is not sustainable. One of the major responsibilities of a TF is to model and co-teach with peers, but the four teachers acting as TF have their own classroom responsibilities, which can sometimes prevent them from focusing on assisting their peers.

**Technical Support Personnel**

- **District Technology Staff** - The perceived commitment from “central office” for a school’s 1:1 project can have a great effect on the morale and level of buy-in by school staff for the project. A school feels supported by their district technology staff when there is a timely response to their requests for assistance and when they are part of the decision-making process. One current
challenge to supporting innovative work in schools is the continued reliance on legacy processes to request and obtain technical and instructional support, and to unblock websites or digital content. For example, in many pilot schools requests to unblock content went directly to technology directors instead of filtering through a tier support structure. One solution implemented by one of the pilot districts is a web-based, work-order system where a designee from each of the high schools fills out an online form that goes directly to the appropriate technician via their district-issued Blackberry. The technician can sometimes address the issue from the field or can forward the issue on to the district technology director if they are in need of assistance. Additionally, teachers expressed concern that there may be only one person, the district technology coordinator, making the majority of the decisions without any input from school staff. We suggest that a representative group of stakeholders including administrators, teachers, students, and central office staff chooses the policies and processes related to technology use in the classroom.

- **Technicians** - At every site visit to the 1:1 schools, staff were adamant about the importance of having a technician on campus to support a successful 1:1 project. Recommendations included one full-time technician for a smaller high school (less than 1000 students) and two full-time technicians for larger high schools (more than 1000 students) implementing a 1:1 project. School staff also recommended that technicians who are hired to work in schools need to be able to work well with the teachers and students. The technicians need to have some understanding and respect for the work of schools – focused on helping students learn.

**Sustainability**

- **School Personnel** - The biggest and most common concern expressed by the staff at the 1:1 pilot schools is continued support of the TF and technician once the 1:1 grant funds are exhausted. Repeatedly the staff indicated that this project could not be done without a full-time, on-site TF and technician at their school. Districts across the state have committed to funding school-level technology personnel. A major recommendation includes working with these districts to find ways to use local funds to continue to support school-based instructional and technical support staff.

- **Unexpected Costs** - Extra batteries, software site licenses, print toner cartridges, print paper, online textbook resources, replacement chargers, and replacing worn laptop carrying bags were not figured into Total Cost of Ownership (TCO) for the school-level laptop projects. These costs are soon going to be a major issue for sustaining the 1:1 project.

- **Engaging Stakeholders** - Schools and school systems cannot and should not do a 1:1 learning initiative in isolation. 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. Private partnerships and local support can help obtain funds for hardware and software needs, as well as commitment from community leaders. State support is needed for personnel and infrastructure resources that are necessary for the success of a 1:1 learning project, such as NC Connectivity Project, NC Virtual Public School, Learn and Earn Online, NC WiseOwl, and NC Learning Objects Repository. These state-funded resources are an investment in equity and quality information for all students and teachers in the state.

**Leadership**

- **Principal Turnover** - Since the beginning of the 1:1 initiative, two principals have left the pilot EC high schools and one assistant principal left the traditional high school. Administrator turnover is always a concern for sustaining innovative practices in schools (Hargreaves and Fink, 2006), and a 1:1 project is no exception. In fact, it may be even more disconcerting for school staff when a principal leaves in the middle of their efforts to implement a 1:1 project because it...
requires a major change to every aspect of how the school does business – teaching changes, learning changes, planning for teaching changes, and processes for managing the students and teachers change. Teachers need consistency in their leaders as they make changes to every other aspect of their work.

- **Teacher Buy-In** – Some of the 1:1 pilot schools paid a great deal of attention to teacher buy-in. Research has shown that the successful adoption of any complex innovative educational initiative requires careful consideration and commitment to developing and exploring the purpose and process of the initiative with school stakeholders (Fullan, 2003). Teachers, parents, students, administrators, and the community need to work together to come to consensus on the plan for implementation of the new initiative and the purpose for making changes to the school.

- **1:1 Leadership Framework** - Key characteristics emerged from the conversations with teachers at the 1:1 pilot schools for school leaders to successfully support a new 1:1 laptop project. These findings support existing research on leadership for innovations in schools, but speak specifically to the experiences of these NC teachers in our NC 1:1 pilot schools. Principals at each of the pilot schools should consider their role in their 1:1 project as it relates to each of the following recommendations:

  **Support Professional Development**
  - Encourage faculty to attend professional development.
  - Provide training opportunities specific to teacher needs.
  - Respond to requests for assistance.
  - Monitor teacher integration during classroom visits.

  **Have Reasonable Expectations for Integration**
  - Understand that incorporating technology may take more time for some people while others can act as technology leaders.
  - Encourage faculty to focus on a few things at a time.
  - Allow time to experiment, frame problems as learning opportunities.
  - Do not mandate daily technology use.

  **Model Technology Use**
  - Use a laptop rather than desktop.
  - Ask for lesson plans to be emailed or sent to a drop box rather than on paper.
  - Use technology for presentations.
  - Use technology to facilitate communication with school staff and the community.

  **Provide Resources and Support**
  - Secure or purchase needed resources (hardware, software, tech support, access to websites).
  - Provide encouragement and support by visiting classrooms, helping with curriculum integration.
  - Arrange schedules to allow for common planning time and group reflection.

  **Communicate**
  - Articulate a vision, exhibit excitement and buy-in.
  - Provide a time for feedback and team problem solving.
  - Include others in decision making (e.g., regarding which software to purchase).
  - Provide opportunities to showcase student work with stakeholders.

**Summary**

The pilot schools continue to build on the critical components of an effective 1:1 computing environment. Adjustments were made to school infrastructures, policies, and staff resources to meet new teaching and learning needs; technology facilitators continued to play a critical role in helping teachers effectively
integrate these new technologies into the classroom; teachers received professional development in important areas and are beginning to make significant changes in their instructional practices; and, students are adapting to and benefiting from the use of laptops in their schools.

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 it takes administrators, teachers, and students time to adjust to the significant, systemic changes enabled by the introduction of a 1:1 learning environment.

The key lessons identified from the year one evaluation still apply during the first semester of year two:

- **Ongoing professional development is imperative.** Professional development needs to be continuous, designed to directly meet the needs of teachers, and customized to the participants’ level of expertise/experience as they become more proficient at using the technology to enhance teaching and learning. Additionally, teachers need opportunities to collaborate and share successful lessons for a 1:1 classroom environment.

- **Defining the appropriate balance between student safety, acceptable use, and access to web-based resources is difficult but important.** 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. To the extent students are prevented from accessing important resources, 1:1 environments will not achieve full potential. Schools need more support in addressing the requirements of the Children’s Internet Protection Act (CIPA) while providing access to valuable education resources. Models of how to create the right balance need to be explored.

- **Classroom management strategies and tools require further investigation.** Teachers continue to look for guidance on issues related to management of 1:1 classes such as student monitoring systems, and collecting and returning student work. Further attention needs to be directed to classroom management strategies and how they can be best supported with technological tools, such as effective monitoring software; centrally-located server resources to provide a protected space for students to save work; and, centrally-supported course management software such as Moodle or Blackboard.

- **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 store and carry laptops safely, 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.
In addition to the continued focus on the lessons identified during year one, the year two evaluation report also highlighted the importance of effective leadership for the successful implementation of a 1:1 learning environment.

- **Consistent, supportive, distributed leadership promotes adoption and buy-in from teachers and students for the 1:1 learning innovation.** Key characteristics emerged from the conversations with teachers at the 1:1 pilot schools for school leaders to successfully support a new 1:1 laptop project including supporting teacher professional growth, setting reasonable expectations for effective technology integration, modeling technology use, readily addressing instructional and technical needs, and communicating commitment to the purpose of 1:1 learning initiative.
References


