Natick Public Schools

21st Century Teaching and Learning Study

Baseline Evaluation Report

February 2013

James Burraston, M.Ed. and Damian Bebell, Ph.D.

Center for the Study of Testing, Evaluation,
and Educational Policy

Lynch School of Education

Boston College


Background and Introduction

“The transition to pervasive computing has profound implications for education and may represent as great a paradigm shift as the invention of writing itself.”
Bull, Bull, Garofolo, & Harris, 2002, p. 1

Few modern educational initiatives have been as far-reaching as placing computer-based technologies into American classrooms. Believing that increased use of computers will lead to improved teaching and learning, greater efficiency, and the development of important student skills, educational leaders and policy makers have made major investments in educational technologies. Since 1996, state and district level agencies alone have invested over ten billion dollars to acquire and integrate computer-based technologies into American classrooms. These investments have led to a dramatic impact on the presence of computers in schools. For example, the number of Internet connecting computers in American classrooms has risen from 1 for every 6.6 students in 2000 to 1 for every 3.1 students in 2008 (Snyder & Dillow, 2012).

As increased access and more powerful technologies have permeated the American classroom, the variety of ways in which teachers and students use computer-based technologies has also expanded. Research exploring the role and effects of computers on teaching and learning suggests a wide variety of potential benefits including increased student engagement, increased efficiency, and the potential to increase student learning. However, for any effect to be realized from educational technology, the technology must be actively and frequently used. Understanding this, research has focused on exploring what factors and conditions are necessary to allow different technology uses to occur (Becker, 1999, Bebell, Russell, & O’Dwyer, 2004). A study of over 4,000 Massachusetts teachers revealed that students’ and teachers’ use of technology varied widely across classrooms with some teachers and students incorporating technology into their daily routines and other classes ignoring technology completely (Russell, O’Dwyer, Bebell & Miranda; 2003). An exploration of what factors related to teachers’ adoption and use of technology revealed that technology access, training and professional development, school leadership, and teacher’s pedagogical approach all played major roles in how teachers’ used educational technology. A national study found that for technology programs to have positive educational impacts, the implementation should include the integration of technology in ELL and special education classes, monthly technology oriented professional development, students collaborating online, and the integration of technology in the core subject areas (Greaves, Hayes, Wilson, Gielenak, & Peterson, 2010).

Given the ways in which technology resources have been traditionally distributed within schools (e.g., in labs, libraries, or on shared carts), many observers have theorized that the scarcity of major student achievement outcomes is due to shared computer and technology access, which typically results in such limited use and impact (Bebell & O’Dywer, 2010; Papert, 1996). In fact, both proponents and opponents of educational technology agree that the full effects of any digital resource in school cannot be fully realized until the technology is no longer a shared resource (Oppenheimer, 2003; Papert, 1992, 1996). Recognizing the limitations of traditional educational technology shared across students and classrooms, there has been a steady and growing interest in 1:1 technology scenarios, whereby all teachers and students have full access to technology.

An increasingly common approach for equipping schools and classrooms with digital technologies is through school renovation and construction projects. Rather than retrofit 21st century tools and resources into pre-computing settings, communities here have elected to entirely restructure their classrooms and
camps to better accommodate digital teaching and learning resources. Over the last three years, the suburban community of Natick, Massachusetts has undertaken such an approach with the design and construction of their new state of the art Natick High School. Beginning years earlier, however, Natick Public School began building capacity and providing additional digital teaching and learning resources into many upper middle school (7th and 8th grade) classrooms. Upper middle school students were provided with 1:1 computing access, which is now ultimately provided to all students in grades 8-12. Teacher access to digital resources has also expanded greatly in the newly opened Natick High School with state-of-the-art robotics labs, music and arts studios, digital projection systems, district-wide Wi-Fi, in addition to teacher laptop computers.

Emerging research and evaluation studies suggest several positive outcomes resulting from 1:1 laptop initiatives including: increased student engagement (Cromwell, 1999; Rockman, 1998; MEPRI, 2003; Bebell & Kay, 2008; Bebell & Kay, 2009), decreased disciplinary problems (Baldwin, 1999; MEPRI, 2003), increased use of computers for writing, analysis and research (Cromwell, 1999; Baldwin, 1999; Guignon, 1998; Russell, Bebell, & Higgins, 2004, Bebell, 2006; Bebell & Kay, 2009), and a movement towards student-centered classrooms (Rockman, 1998; Russell, Bebell & Higgins, 2004). Baldwin (1999) documented students spending less time watching television and more time on homework. In addition, an early evaluation of the Maine Learning Technology Initiative (Silvernail & Lane, 2004) and another study of an upper elementary laptop program in Andover, Massachusetts (Russell, Bebell, & Higgins, 2004) provide evidence of substantially more technology use occurring in science and mathematics classes than had been found in studies that focus on non-1:1 laptop settings (Ravitz, Wong, & Becker, 1999; Russell, O’Brien, Bebell, & O’Dwyer, 2003). It is important to also consider that the educational technology and its uses are evolving so quickly that much of the literature from even five years ago fails to address the dynamic digital learning tools now accessible in the classrooms of Natick High School. Like all areas of computer technology, digital learning tools are evolving rapidly and continuously expanding the notion of what is even possible.

Although many political leaders suggest that providing students access to powerful and widespread technology will result in long-term economic prosperity, the impacts on student learning (as measured by empirical quantitative research) remains a focus for many. Despite growing interest in and excitement about 1:1 computing, there remains a lack of sufficient, sustained, large-scale research and evaluation that focuses on teaching and learning in these intensive computing environments. Specifically, there continues to be a lack of empirical evidence that relates use of technology in these 1:1 settings with measures of student achievement. This is a particularly salient issue in light of the high cost of implementing and maintaining 1:1 laptop initiatives and the current climate of educational policy whereby student achievement is held as the benchmark of successful school reforms and initiatives under state and federal mandates such as NCLB. As recently documented in a series of NY Times articles (Richtel, 2011), many policy makers and educational observers feel that research and evaluation of educational technology has failed to keep pace with the investments and expectations of the public. “In a nutshell: schools are spending billions on technology, even as they cut budgets and lay off teachers, with little proof that this approach is improving basic learning.” (Richtel, 2011)

**Natick Public Schools Evaluation Study Design and Background**

“For want of records, much useful knowledge is continually lost. Though many individuals have derived advantages to themselves from experiments, but few have recorded them. Even those who make experiments are liable to forget them, so as to give incorrect representations of them when they try to relate them.”

Empirical research and systematic reflection are critical components of Natick Public Schools sustainable long-term implementation of 1:1 student computing and use of varied digital teaching and learning tools. During the inaugural school year of Natick High School (2012-2013), Boston College partnered with Natick Public Schools to develop and implement an evaluation study to collect and analyze data concerning students’ and teachers’ use of technology to support teaching and learning.

At the request of the Natick schools, the current investigation focuses on documenting the most immediate impacts and changes as students and teachers transition to new 1:1 computing environments over the 2012/2013 school year. As such, the current evaluation will follow teachers and students through their first year at the new school facility from September 2012 to June 2013. However, many of Natick Public Schools more far-reaching program goals will require additional resources and time for more comprehensive evaluation. Although the current proposal recognizes such long term goals and empirical outcomes, the focus here is primarily on documenting the evolving teaching and learning practices afforded by the rich learning settings over the 2012/2013 school year. Although valuable for reflection and formative assessment, this data collected throughout Year 1 will provide the nucleus for all future inquiries and investigations.

This report describes the initial (November-December 2012) results summarizing how Natick teachers and students, now participating in 1:1 computing, access, use, and relate to technology in support of teaching and learning. Two years before the launch of the 1:1 computing program (September 2010), this year’s current ninth grade class participated in a survey of teaching, learning and computing practices for Boston College when they were beginning seventh grade (September 2010). This data, collected from over 92% of the NPS seventh grade student population, provides a valuable snapshot of students learning practices as well as their attitudes and beliefs towards school and computing technologies before 1:1 computing. This report examines and compares results from current NHS student cohorts to past (pre-1:1) practices and beliefs. So, in addition to examining practices and attitudes across teachers and students during the 2012/2013 school year, this study examined students’ prior survey data to address potential differences in pre and post-1:1 practices and attitudes.

**Data Collection Procedure/Response Rates**

Online teacher and student surveys were completed by nearly all members of the grade 7 through 12 community during the last week of November and the first week of December 2012. Building on past research and evaluation instruments, both the teacher and student surveys were customized for the specific needs of the NPS community.

**Student Survey**
The student surveys provide the district with a summary of how students in grades 7-12 engage and employ a variety of digital resources to further their education. The online student survey provided measures of students’ access to technology in school, use of technology in school across subject areas, personal comfort level with technology, access to technology at home, and various uses of technology at home. Students are scheduled to complete a more detailed student survey in May 2013.

Administering the student survey online decreases the time needed by students to complete each survey. In this case the median time students spent responding was about 10 minutes and 20 seconds. An online survey also makes it easier to work with school administration to ensure a high response rate through the real-time monitoring of survey data via daily email updates. It should be noted that student names and
school information were only used for internal tracking of survey completion and all survey responses are strictly anonymous and confidential.

**Teacher Survey**

Like the student survey, an online teacher survey was administered in Fall 2012. The teacher survey included item sets dedicated to capturing the variety and extent of teachers’ technology use, teachers’ attitudes toward technology, teaching, and learning, as well as teachers’ beliefs on student motivation and engagement. The teacher survey also included brief item sets that measured more general pedagogical practices and classroom practices. Collectively, these items serve to demonstrate the extent to which digital technology resources are utilized in the approach and delivery of the curriculum (as well as various components of teacher/student interactions).

**Response Rates**

Before the survey period, school administrators provided the research team a roster of eligible students and teachers. While the current focus is on overall technology use across the Natick schools, students enrolled in certain special education programs, and teachers in those programs, and other auxiliary teaching staff were exempted from the baseline survey. The eligible student and teacher rosters were then used to monitor survey response rates and provide daily reports detailing which individuals had not yet completed surveys. Such practices, in conjunction with highly effective on-site leadership, resulted in excellent student and teacher survey response rates. Table 1, below, shows the student survey response rates.

**Table 1 – Fall 2012 student survey response rates across participating grades and schools**

<table>
<thead>
<tr>
<th>School Name</th>
<th>Grade</th>
<th>Total # of students</th>
<th># Completed Surveys</th>
<th>Response rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kennedy Middle School</td>
<td>7</td>
<td>166</td>
<td>157</td>
<td>95%</td>
</tr>
<tr>
<td></td>
<td>8</td>
<td>137</td>
<td>135</td>
<td>99%</td>
</tr>
<tr>
<td>Wilson Middle School</td>
<td>7</td>
<td>212</td>
<td>197</td>
<td>93%</td>
</tr>
<tr>
<td></td>
<td>8</td>
<td>214</td>
<td>214</td>
<td>100%</td>
</tr>
<tr>
<td>Natick High School</td>
<td>9</td>
<td>383</td>
<td>369</td>
<td>96%</td>
</tr>
<tr>
<td></td>
<td>10</td>
<td>330</td>
<td>309</td>
<td>94%</td>
</tr>
<tr>
<td></td>
<td>11</td>
<td>328</td>
<td>273</td>
<td>83%</td>
</tr>
<tr>
<td></td>
<td>12</td>
<td>313</td>
<td>266</td>
<td>85%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td><strong>2083</strong></td>
<td><strong>1920</strong></td>
<td><strong>92%</strong></td>
</tr>
</tbody>
</table>

As shown in Figure 1, the overall student survey response rate was excellent with 92% of the targeted Natick student population completing the Fall 2012 survey. Response rates varied slightly more by grade level, than by school. For example, 11th and 12th grade response rates were about 10 percentage points lower than in other settings, but still represented over 80% of each grade’s student population. The 8th grade response rates were strongest with over 99% of students completing the survey. Based on these response rates, we can be quite assured the vast majority of students’ practices, opinions, and voices were captured in the Fall 2012 survey.

As can be seen in Table 2, teacher survey response rates were similarly strong for the Fall 2012 teacher survey, with 95% of the eligible teacher population completing the survey.
Table 2 – Baseline teacher response rates

<table>
<thead>
<tr>
<th>School Name</th>
<th>Total # of teachers</th>
<th># Completed Surveys</th>
<th>Response rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kennedy Middle School</td>
<td>31</td>
<td>30</td>
<td>97%</td>
</tr>
<tr>
<td>Wilson Middle School</td>
<td>47</td>
<td>44</td>
<td>94%</td>
</tr>
<tr>
<td>Natick High School</td>
<td>96</td>
<td>92</td>
<td>96%</td>
</tr>
<tr>
<td>Total</td>
<td>174</td>
<td>166</td>
<td>95%</td>
</tr>
</tbody>
</table>

Student Survey Results

Frequency and location of student computer use in school

Figure 1 – Average Frequency of NPS students’ computer use in the classroom (Fall 2012).

Overall, Natick students reported very high levels of access and technology use, both inside and outside of school. In the Fall 2012 survey, students across the Natick 7th-12th grades (n=1920) reported overwhelmingly frequent use of computers in school. Specifically, 72% of all student respondents reported using computers in their classroom every day. The high frequency of classroom computer use by students was consistent across the three schools and across grades 8 through 12. Less than 1% of surveyed students claim to never use a computer in school. Although the frequency of student computer use is similar across grade levels, Fall 2012 results consistently showed 7th grade students using computers much less frequently than students in other grades. Because 7th grade students were surveyed in Fall 2010, it is possible to examine the degree to which conditions and practices changed by comparing the Fall 2012 results with those from the 7th graders two years before.
Comparing the Fall 2010 and Fall 2012 survey results, we observe a robust increase in the frequency of students’ computer use. In the two years between survey administrations, classroom use of technology increased by more than ten fold for the current 9th grade students, while lab and library use levels remained about the same. Originally in the 2010 survey, students reported more frequent use of computers in labs than in classrooms, but by 2012 7th graders reported using computers in both locations with similar frequency. These dramatic changes can be clearly seen in Figure 2, where almost 50% of the 2012 student responses report never using computers in labs while over 90% of that group reported using computers in their classrooms every day in the 9th grade.
Figure 2 also allows comparison of 7th grade practices in 2010 compared to the 7th grade practices two years later in 2012. Although the increases in classroom use were less robust as 7th grade students matriculated into the 9th grade 1:1 program, current 7th grade use patterns have also shifted from 2010 practices. For example, 50% of the 7th grade 2010 students reported using a computer in the classroom only “a couple times a year”, which increased for 7th graders in 2012 to “once every couple of weeks”. From these results, it is clear that students are experiencing a major increase in their access and frequency of technology use of the classroom.

When examining the Fall 2012 student survey results, classroom use was very frequent, almost every day, (measured against 180 school days per year) in nearly every grade level surveyed. Seventh grade students, lacking access to 1:1 student computers, reported substantially less frequent use of computers in class than any other grade level, as shown above in Figure 3. Students reported computer use in labs and libraries similarly across grades (generally a couple times a month), except in the 11th and 12th grades where students used computers in the library twice as often as the younger high school students.
As shown above in Figure 4, Natick students across grade levels reported very frequent use of technology across the curriculum in many subject areas in the Fall 2012 survey. It is clear that Natick students are using computers to support a wide variety of curricula. Trends across subject area were similar across the grade levels with 1:1 access, with the most frequent use in English, social studies, science, and technology classes. In technology classes 7th graders were as likely to use technology as students in the other grades, but the lack of 1:1 student computing access limited 7th grade in most subject areas. For most subject areas the 8th through 10th grades tended to use computers on more days than that reported by the 11th and 12th graders. While use in math class typically lags behind use in other core subject areas, 8th graders are reporting very frequent use of computers in math class.
Figure 5 – Average number of days in each subject area were computers were reported to be used by 7th graders in 2010, the same cohort as 9th graders in 2012, and the current 7th grade cohort (Fall 2012)

Figure 5 shows a massive increase in the frequency that Fall 2012 9th grade students reported using computers across their classes over the past two years. Even in classes with relatively infrequent computer use, students’ use of computers was many times greater in Fall 2012 than it had been in the same subjects just two years prior (Fall 2010). Such a substantial increase in one cohort of students’ computer use in class over this two-year period is noteworthy. Looking exclusively at 7th grade students results in 2010 and 2012, rates of use were generally much more similar. For example, in 2012 7th grade students reported using computers more than twice as often in math and science than the 7th graders from two years before in 2010, on average.
Figure 6, above, further examines the extent to which the Natick middle school students used computers in class in the fall of 2012. Averages for each middle school and subject area were calculated to represent the estimated number of days in the school year that a student would expect to use a computer in each of their classes. Seventh grade use occurred with similar frequency in both schools across subject areas. In the 8th grade where 1:1 student computing has been established for the past two years, computer use was very frequent in both schools, although Kennedy Middle School students reporting somewhat frequent use in all subject areas (except technology). Figure 8, below, shows a similar pattern in how students use computers in class by examining the percentage of actual class time students where students reported using computers across core subject areas.
Figure 7 – Average percentage of class time when computers were used by grade level (Fall 2012)

Examining the Fall 2012 averages across grade levels, Figure 12 shows 1:1 students estimated spending between 30% and 80% of their class time in core subject areas using computers. Students generally reported spending the highest percentage of class time using computers in Social Studies, English, and Science. Overall, students reported the least frequent use of computers in math classes, except for 8th graders who report spending an average of 60% of math class using a computer. As previously observed, 7th grade students typically reported lower percentages of class time using a computer.

*Student reported use of computers by teachers*
In both the 2010 and 2012 surveys, students were asked to consider how frequently they observed their teachers using computers in school. Figure 9, below, shows the average frequency of teacher use of computers over the school year as reported by students, in each grade level and across subject areas.

The student estimates on how frequently their teachers used computers in class formed a similar pattern to the student use pattern with the most frequent technology use in English, social studies, and science classes. Although 7th graders reported that their teachers use computers less often than teachers in the other grades, they still indicate that their teachers were using computers on about every other day in core subject areas. Looking at the Fall 2012 results, teachers’ frequency of computer use was substantially greater than the students’ estimated use by anywhere from 10 to 75 days depending on subject and grade level. The smallest difference between student and teacher use was reported by 8th graders for social studies, with teachers using computers an average of 1 day more per year than students. Further patterns of student-reported teacher computer use are depicted across subject areas and grade levels in Figure 9, below.
It is clear from these results that the vast majority of Natick’s middle and high school teachers were consistently and frequently using computers in class. The most frequent use reported for teachers (by their students) was observed in the core curricular subjects of ELA, Math, Science, and Social Studies where teachers used computers in class during the majority of school days. Teacher use was reported less frequent in other subject areas such as performing arts, visual arts, and Health/PE. An interesting trend in teacher use was also observed across grade levels in technology classes where teacher use was less frequent in the high school.
Similar to the increase in students’ frequency of computer use over the two-year study period, teacher use of computers also increased dramatically across the 2010 and 2012 surveys, as shown in Figure 10. Seventh grade teachers’ use of computers in class increased substantially in the two-year period from 2010 to 2012, as reported by each cohort of 7th grade students. Following the 2010 7th grade cohort into 9th grade in 2012, students witnessed an even larger increase in the frequency of their teachers’ use of computers in class.

**Students’ classroom computer use activities**

As shown below in Figure 11, when asked how often they engage in a number of classroom learning activities using computers, students across all settings reported widespread and frequent use of a large number of computer-based learning activities in the Fall 2012 survey.
Figure 11 – Average number of days per school year that students reported various computer-using activities by grade level
As shown in Figure 11, the most common classroom computing activities tended to be the relatively passive forms of learning on the list (e.g. searching for information and accessing a video) or procedural tasks (e.g. looking up grades and keeping track of assignments). The more constructive and learner-centered activities occurred only about half as often. When looking across grade level averages, 7th grade students reported less frequent specific uses of technology than students in other grade levels.

When the frequency of all computer-related activities is compared with the same students two years earlier, as shown below in Figure 12, even relatively infrequent tasks such as playing educational computer games, and making presentations increased substantially by Fall 2012. The new cohort of 7th graders also reported increased technology use in most categories, sometimes doubling the previous frequencies. But change within the 7th grade wasn’t nearly as dramatic as the one that occurred as students moved into Natick High School.

Figure 12 - Average frequency of student classroom activities as reported by 7th graders’ in 2010, the same student cohort as 9th graders in 2012, and the 2012 7th grade cohort

Again, in the two years between 2010 and 2012, 9th grade students reported major increases in the frequency with which they used computers and technology in school for a wide variety of purposes. Some of the largest proportional increases occurred nearly daily in 2012 on average, such as taking notes in class and keeping track of schedules, which 9th graders in 2012 reported doing about 30 times as often as they did as 7th graders in 2010.
Student attitudes about using computers in school

In Figure 13, below, student attitudes about using computers in school are examined across grade level.

In Figure 13, values above zero indicate positive agreement while values below zero represent negative sentiment or disagreement to statements from the Fall 2012 student survey. In general, student attitudes across all grade levels were quite positive towards using computers. On average, Natick students agreed that computers improved the classroom experience and disagreed that using computers made school work more challenging. Students were more ambivalent about how much the technology distracts them. Across aspects of using computers in school, 1:1 student attitudes tended to be more positive among the younger grades and less so among the older students.

Figure 14, below, further explores how positive overall student sentiment was toward technology and computers.
As shown above in Figure 14, the Natick students who completed the Fall 2012 survey (n=1920) overwhelmingly agreed that using computers helped them to keep track of their assignments, but were less sure if using computers distracted them in school.
Figure 15 shows the average student sentiment towards their school and different aspects of the technology program for each participating school. Overall, Natick students in each setting consistently found the resources and tools used by their school to function effectively. On average, students were more ambivalent in their beliefs about peers’ ability to circumvent the school’s Internet filtering.

In order to explore in greater detail how students experience these aspects of using technology in school, it can be helpful to examine the distribution of student ratings. Figure 16, below, details the fact that most Natick students rated the quality of school laptops and network speed highly, with some variation.
Figure 16 - Distribution of student ratings for aspects of the technology-based learning environment and experience (Fall 2012)
Nearly a third of all surveyed Natick students reported that their school pride and their Internet security were excellent at the highest level possible, while the remaining students represented a diverse range of opinions, including a small minority of students who rated both of these elements as ‘poor’ at the lowest level. Student beliefs about their peers’ ability to access Internet resources despite filtering systems were more diverse than other beliefs, with a notable group of students who believed that their peers’ skills were excellent, and a larger group who claim they were poor.

**Student access and use of technology at home**

In both the Fall 2010 and 2012 surveys, students were asked to report the number and range of computers and other digital technology they had access to at home. Figure 17 displays the Fall 2012 average student access to home computing devices across grade levels.

**Figure 17 - Average number of computing devices students reported at home across grade levels (Fall 2012)**
In the Fall 2012 survey, the vast majority of students reported widespread access to a large range of computing devices. For example, students reported the most access to laptops, MP3 players, and smartphones. It may also be worth noting that students have the least access to devices that have been more recently developed, such as tablets and eReaders. Even so, about half of students reported having access to at least one for each of these devices, and the younger students are reporting having more of them, on average.

In addition to reporting the average number of devices, it is also possible to look at what proportion of the Natick student respondents (n=1920) reported access to at least one of each type of device at home, as shown in Figure 18, below.

Figure 18 - Proportions of all students who have access to at least one of each computing device at home (Fall 2012)

As shown in Figure 18, when examined proportionally, the most common device across all of the Natick students was a laptop computer (93% of all respondents). MP3 players and game-stations were also common, as well as smart phones. These results may represent the difference between devices that are shared in the home as opposed to devices where family members might each have their own. It may also represent upgrade and replacement dynamics, where frequently upgraded devices accumulate in the household. Figure 19, below, further examines school differences in students’ home access to technology across each of the surveyed schools.
When the percentage of students with access to each type of device is examined for each school, as shown in Figure 19, middle school students may be less likely to have laptops than high school students, and more likely to have tablets and eReaders. Fall 2012 survey results also show that students in Wilson Middle School have slightly lower access to technology than their Kennedy Middle School peers. However, these differences between schools are too slight to represent meaningful differences in students’ home access to technology. Figure 20, below, further details Natick students’ access to each type of computing device.
Again it is clear from the survey results that students were more likely to indicate that they have access to three, four, or more MP3 players and smart phones than they are the other devices. More than half of students reported having access to at least 2 laptop computers, while a total of only 22 Natick students (1.2%) reported they did not have access to either a laptop or desktop computer at home.
Because having access to a computer at home is not the same thing as using one, students were additionally asked to reflect how frequently they used computers at home on school days and on weekends. On average, students reported using computers for roughly two hours a day in their homes. While middle school students reported slightly more use on weekends, Natick High School students reported spending, on average, 17 more minutes using computers on weekdays than on non-school days. Figure 22, below, shows how students are distributed by the amount of time they use computers at home.
As shown in Figure 22, the difference between average weekday and weekend use is apparent as students are more likely to use computers in the 90 to 210 minute range on weekdays rather than weekends. On weekends and school holidays students seem to be divided into a large group who use computers for less time than when they have school, and a smaller group of students who use computers for very large amounts of time when they don’t have school.
Looking at student home computer trends over the past two years, there was an increase in students’ home computer use in the Fall 2012 survey. As shown in Figure 23, 65% of 7th grade students in 2010 reported using computers at home for 30 minutes or less on school days, while only 8% of the same cohort reported 30 minutes or less in Fall 2012. Although the students have increased the amount of time they spend using computers at home overall, the shift has not been uniform as students are reporting a wider range of use patterns than in 2010. Reflecting previous data, the 2012 survey permitted students to report up to 6 hours of home computer use. However, the shape of the 2012 cumulative percent curve for the 9th graders at 330 minutes suggests that a small number of students might have reported on the order of 10 hours (or more) of computer use per day, had the survey allowed it.

Although this change is more dramatic for the 9th grade group, the current 7th graders were reporting more time using computers as well. This can be seen as fewer of them indicated spending 30 minutes or less and more of them claim to use computers for 60 or 90 minutes per school day.
In order to see how much of students’ computer use time was for homework, students were asked to report how much time they spent doing homework, and what percentage of that time they used a computer. The averages for each grade level are shown in Figure 24. On average, Natick students reported spending about 109 minutes per day on homework in Fall 2012, and further reported using a computer for nearly 74% of those minutes. Students’ average number of minutes doing homework differed little by grade level in high school; however, 8th graders reported the highest overall percentages of homework completion using computers.
When students were asked to identify which web-based services they subscribed in Fall 2012, Natick High School students reported having about twice as many Facebook accounts as the middle school students, and almost three times as many Twitter accounts. The most popular service, of those included on the survey, was the media distribution site iTunes. As depicted in Figure 25, more than half of students reported using Skype as well. Although media consuming and social networking were more popular, the roughly 10% who blog and/or have their own website is a sizable group of students who use technology for production as well as consumption of information.
As shown in Figure 26, students reported many changes in what they did with technology at home between 2010 and 2012. Over the two-year period the current 9th graders’ blogging has nearly doubled while their use of Facebook has nearly tripled, and their Twitter use has increased to about nine-times its 2010 levels. However, the current 7th grade subscription to these services isn’t very different from the earlier group except in Twitter use, which has increased by nearly three times.
In order to get a more thorough look at student’s home computing activity, students were asked to report how much time they spent in a typical day engaged in a number of specific tasks. As shown in Figure 27, students regularly used their home computer or technology devices for a wide variety of personal and school-related activities. The home activity where students reported the most time (an average of 54 minutes per day) was chatting or texting with friends. Students also reported spending approximately 39 minutes per day searching the Internet for fun and 36 minutes searching the Internet for school. With students spending so much time searching the Internet for information, it may be educationally relevant to take a closer look at what types of information students are accessing and how they use what they find. Students reported spending relatively little time creating content for the web or shopping online.
Teacher Survey Results

Like their students, teachers reported spending a great deal of time using computers for a range of activities, both inside and outside of school. In addition, teachers express positive attitudes towards using computers for teaching and describe employing it in a number of ways to improve their instruction. For some of the questions on the survey only small differences were found between the teachers of different schools. Within and across the schools, interesting patterns were observed based on the teachers’ content areas. For purposes of grouping by subject area, teachers of more than one subject were included in each subject they teach in. Therefore, the sums of columns in Table 3 are greater than the totals indicated at the bottom of the table. Teachers who identified their subject as “other” indicated that they taught either technology or special education classes.

Table 3 – Natick secondary teachers who responded to the teacher survey by subject area

<table>
<thead>
<tr>
<th>Subject</th>
<th>Total</th>
<th>Kennedy # of teachers</th>
<th>Kennedy % of subject area teachers</th>
<th>Middle School # of teachers</th>
<th>Middle School % of subject area teachers</th>
<th>Wilson # of teachers</th>
<th>Wilson % of subject area teachers</th>
<th>Natick High School # of teachers</th>
<th>Natick High School % of subject area teachers</th>
</tr>
</thead>
<tbody>
<tr>
<td>English</td>
<td>28</td>
<td>4</td>
<td>14%</td>
<td>8</td>
<td>29%</td>
<td>16</td>
<td>57%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Arts</td>
<td>18</td>
<td>3</td>
<td>17%</td>
<td>6</td>
<td>33%</td>
<td>9</td>
<td>50%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Foreign language</td>
<td>21</td>
<td>3</td>
<td>14%</td>
<td>5</td>
<td>24%</td>
<td>13</td>
<td>62%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Math</td>
<td>29</td>
<td>4</td>
<td>14%</td>
<td>9</td>
<td>31%</td>
<td>14</td>
<td>55%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Health / PE</td>
<td>17</td>
<td>4</td>
<td>24%</td>
<td>4</td>
<td>24%</td>
<td>9</td>
<td>53%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Science</td>
<td>29</td>
<td>4</td>
<td>14%</td>
<td>8</td>
<td>28%</td>
<td>17</td>
<td>59%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Social studies</td>
<td>26</td>
<td>4</td>
<td>15%</td>
<td>8</td>
<td>31%</td>
<td>14</td>
<td>54%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td>19</td>
<td>5</td>
<td>26%</td>
<td>7</td>
<td>37%</td>
<td>7</td>
<td>37%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>169</td>
<td>30</td>
<td>18%</td>
<td>44</td>
<td>26%</td>
<td>95</td>
<td>56%</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

When asked to rate their preparedness to use technology for instruction, Natick teachers reported overwhelmingly that they felt at least somewhat well prepared to teach. Teachers tended to rate themselves a little over 3, where 1 = “Not at all prepared”, 2 = “Somewhat well prepared, 3 =

Figure T28 - Teachers’ ratings of personal preparedness for using technology in their teaching (Fall 2012)
“Moderately well prepared, and 4 = “Very well prepared.” The largest group of teachers (42%) indicated they were very well prepared to use technology.

Classroom technology use and instructional practice

In the Fall 2012 survey, teachers were asked to describe a typical day in their classes by indicating how much class time was spent in a number of activities. These activities were reported in percentages across each participating school in Figure T29.

Figure T29 - Proportion of class time that a series of activities occur in a typical day by school (Fall 2012)

Teachers typically reported that students were engaged and on-task during class. On average, Natick teachers reported spending about half of class time using a computer to present information to their students across schools. While teacher activities were similar between schools, there were some notable differences between schools in teachers’ reports about student activities. In Natick High School, teachers reported that students used computers for a greater portion of class time than in the other schools. Kennedy Middle School teachers reported students being more likely to work in groups, while Wilson Middle School teachers reported students spending a greater part of class time working individually.
When these activities were examined across teachers’ subject areas, other patterns were observed. Foreign language and social studies teachers reported themselves as spending the greatest portion of class time using computers to present information, at more than 60%. Conversely, health and PE teachers reported the lowest relative levels of computer use by teachers or students. Another subject area difference can be seen at the bottom of Figure T30, where art teachers reported their students spent about 50% of class time working on their own interests, more than double most of the other subject areas.

Teacher and classroom practices are further explored in Figure T31, where teachers reported how often they used technology for a number of instructional and professional purposes.
The most commonly surveyed ways teachers used computers were to access administrative records and use Google Docs, both of which occurred on most school days for most teachers. Natick teachers reported using computers to research lessons online and to deliver instruction in class about every other day. Creating new materials using a computer was reported less commonly and computer use for assessment was reported for once every 9 or 10 days.

Out of the possible 180 instructional days in a school year, Wilson teachers reported somewhat more Google Docs use than teachers in the other schools. They also report differentiating instruction for an average of approximately 25 more days than their Kennedy and Natick High colleagues.
Middle School teachers also reported using computers to assess students less than half as often as teachers in the other Natick schools. Natick High School teachers again indicated requiring their students to use computers more frequently than teachers in the other schools, so the high school students were using computers both more often and for a greater proportion of class time. This included more student use of online applications.

Figure T32 - Average number of days per school year that teachers’ reported various instructional practices and computer-using activities by subject (Fall 2012)
When examined across all subject areas, health and PE teachers reported lower frequencies of use with similar conditions in arts classrooms, as shown in Figure T32. Social studies teachers reported creating new lesson content in media and for the web more frequently than teachers in other subject areas, with an average just under 90 days per school year (about every other day). In terms of practices that are not technology dependent, most subject area teachers indicated that they differentiated instruction on more than 2/3 of school days, while foreign language teachers reported differentiating on fewer than half.

Teacher attitudes towards using technology in school

In general, teachers reported positive attitudes towards using computers for teaching and learning, as shown below in Figure T33.

Figure T33 - Average teacher attitudes towards teaching practices and using computers in class by school (Fall 2012)

Overall, 60% of teachers agreed that computers contributed to their enthusiasm and 73% to their effectiveness. Looking across Natick schools, teachers at Kennedy demonstrated a greater preference for
technology across survey items. Compared to other schools, Natick High teachers were more likely to “agree” that computers served as a distraction for students.

Figure T34 - Average teacher attitudes towards teaching practices and using computers in school by subject (Fall 2012)

Overall, teachers largely disagreed with the suggestion that student computer use made teaching harder, or weakened students’ research skills. However, 56% of Natick teachers reported that students can be distracted when using computers. When examined across different subject areas, Fall 2012 results show that this belief was strongest among foreign language teachers. As shown in Figure T34, this group is
also the only one that, on average, believes computers contribute to student laziness. Otherwise, teacher beliefs about using computers in class are similar across subject specialty.

Looking across the Fall 2012 teacher sentiments, larger differences were observed in teacher attitudes by subject area, irrespective of technology. For example English and arts teachers were the more likely to assign long-term projects to their classes while math and foreign language teachers were more likely to assign simple, accessible problems. Additionally, social studies and health/PE teachers were substantially less likely to report that “too many students needed their help”.

Figure T35 - Average teacher attitudes towards using computers in their work by school (Fall 2012)
Teachers were also asked to reflect on how they personally experience using computers in their work. Again, the overall attitude of Natick Public School teaching staff was quite positive, indicating positive impacts of technology. Rather than between school differences, more variation was again observed between teachers of different subject areas. Figure T35 shows that arts teachers were the least likely to believe that computers brought additional interest or fun to their classes. Meanwhile, foreign language and social studies teachers were most likely to indicate that computers made their teaching more challenging.

Figure T36 - Average teacher ratings for aspects of the technology-based learning environment and experience (Fall 2012)

When asked about the technological aspects of the new school environment (quality of the laptops, Internet speeds) teachers tended to be more positive than their very positive students, giving average ratings about 10 points higher on the 100-point scale. This pattern was consistent across all of the surveyed Natick schools, while teachers also reported high levels of school pride. There was little difference between teachers across the different subject areas in these beliefs.

Interestingly, teachers’ average ratings on both the Internet filter effectiveness and students’ skill in circumventing the filters were also about 10 points higher than the students’ ratings. However, while there was no difference observed among students between schools on this issue, Kennedy teachers’
confidence in the overall Internet security tended to be higher than that of the Natick High School and Wilson Middle School teachers.

Teacher access and use of technology at home

As with their students, teachers reported high levels of access to portable computing devices at home. On average, they claimed to have more than one laptop, mp3 player, and smart phone each. But across all items except eReaders, Natick students actually reported higher levels of home access. While eBook readers were the least frequently reported devices by students, they were ranked similarly to tablet devices and desktop computers among teachers’ technology access.

Figure T37 - Average number of computing devices teachers reported at home across subject areas (Fall 2012)
While there was little difference between schools among teachers’ home access, Figure T37 shows some differences between teachers by subject area. For example, social studies and science teachers had fewer smart phones on average than other teachers. English teachers were more likely to have eReaders by about the same amount as art teachers counted more desktop computers. The most pronounced difference was found for gaming stations where art teachers claimed to similar numbers as their students, while most teachers reported only half as many.

In addition to the number and type of devices they can access, teachers were asked to report on how much time they typically spend using computers at home on a school day or on the weekend. They were also asked how much time they spent each day using these devices for a varied list of activities. On average, teachers reported 95 minutes of home computer use per school day, about 30 minutes less than the average student. Middle school teachers reported spending a little more time than their students, while the high school teachers spent less. Teachers across schools, as seen in Figure T38, spend upwards of 30 minutes more per day on the weekend than they do on school days. Compared to their students in the Kennedy and Wilson Middle Schools, this difference is only about 10 minutes, while at Natick High School the trend is reversed.

As shown above in Figure T38, Natick teachers reported spending, on average, at least several minutes a day engaged in a number of home computing activities. Of the survey’s listed activities, teachers spent the largest amount of their time searching the Internet for school, which ranked third for students. Both students and teachers reported spending about 40 minutes per day on this activity. Students’ most time-consuming activity of chatting and texting for over 50 minutes a day falls to a mid-level activity among teachers at fewer than 15 minutes per day. Searching the Internet for fun remained relatively popular activities among both groups, though the students spent considerably more time than teachers reported for themselves.
As displayed in Figure T39, there was very little variation between Natick schools in terms of teachers’ home computer use activities. One notable exception was that Kennedy teachers reported substantially more time creating media to post online than did the other teachers.

Some of the differences between teachers’ home technology use can be seen by subject area in Figure T40. One of the most obvious results is that foreign language teachers reported searching the Internet for class an average of 10 minutes more than other teachers. The same teacher cohort also reported spending more time searching the Internet for fun. Meanwhile art teachers report unusually high amounts of time using social networking sites, chatting or texting, playing computer games, and creating media to post online. Video and audio conferencing were reported as uncommon activities by teachers generally, but no English teachers reported spending any time at this activity.
Figure T40 - Average number of minutes where teachers reported home computer use by specific activities and across schools (Fall 2012)
In the Fall 2102 teacher survey, Natick teachers reported subscribing to several online services. The most popular online services were iTunes, Amazon, and Facebook, respectively. One of the conspicuous differences between teachers’ and students’ website accounts is that teachers are about three times as likely to have an Amazon account. In fact nearly all of the Wilson Middle School teachers report having Amazon accounts. Another school-level difference between teachers was found in the high school teachers having their own websites at nearly twice the rate of middle school teachers.

When teachers’ Internet accounts were compared across subject areas art teachers were more likely than others to have their own blog or website. This would be consistent with the increased time spent creating media for posting online. However, health/PE and science teachers also reported high rates of possessing their own websites.
Figure T42 - Average percent of Natick teachers who report various home computer accounts by subject (Fall 2012)
References


