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REPORT

Berkshire Wireless Learning Initiative

Year 2 Evaluation Report

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Executive Summary

The current report is the second annual report provided to the Massachusetts Technology Collaborative by Boston College's Technology and Assessment Study Collaborative evaluation team concerning the educational impacts of the Berkshire Wireless Learning Initiative. Included in the current reports are summative and formative results from a variety of data collected during the first two years of the project's implementation. Data from the five BWLI schools is examined over time as well as in comparison to two matched comparison schools. In addition, the report also summarizes the current status of Year 3 (2007–2008) BWLI laptop deployment. Highlights from the report include:

BWLI fundraising complete

According to project management, the BWLI project has secured 100% of its overall $3,180,979 budget. Specifically, $1,040,650 was successfully raised through fundraising efforts in addition to the $240,329 provided by the participating schools and the $1,900,000 provided by the state.

Year 3 student laptop deployment completed

All of the BWLI schools provided their students with school-issued laptops within the first two weeks of the 2007–2008 school year. This includes students across all grade levels. However, only at the Pittsfield parochial schools do a large proportion of students systemically take their school laptops home with them.

Excellent data collection and response rates

Year 2 data collection (May–June 2007) was the most successful to date with response rates over 95% for both the BWLI student and teacher surveys across all participating schools.

BWLI teachers report widespread use of technology in Year 2

The teacher survey results show that BWLI teachers used educational technology more frequently in Year 2 then they had before the program. According to survey data from the first two years of the BWLI program, participating teachers generally reported substantial increases in all uses of educational technology. However, uses of technology for planning and preparing lessons continued to increase throughout the second year of the study while instructional uses (i.e. students' direct experience of teachers' technology use) decreased slightly in Year 2 of the program to more closely resemble the original pre-student 1:1 laptop results from January 2006. However, two years into the BWLI program there is clear evidence that teachers have adopted and continue to make widespread and frequent use of technology across nearly all aspects of their teaching practice. Additionally, Year 2 data revealed notable variation in teachers' technology use patterns at each of the participating 1:1 schools, suggesting that teachers and schools have integrated technology use to suit their specific educational needs.

Similarly, BWLI teachers were also asked to reflect on how frequently they asked their students to create work and products using technology during the second year of the BWLI program. Looking across all the types of surveyed technology products, we see that there has been a substantial and steady increase in the total frequency with which BWLI teachers assign their students to complete projects and create products using technology.

Differences in patterns of teachers' technology use was observed across the BWLI schools:

Looking cumulatively across the subject areas, we see that teachers used computers less in Math than other classes and most frequently in Social Studies and Reading/ELA, similar to the student use results. However, teachers' reported use of technology fluctuated less than students' use of technology across subject areas and across schools. In other words, there is less variability in teachers' frequency of technology use across subject areas than was observed for students' use.

Teacher report program impacts

Looking across all of the teacher survey responses, BWLI teachers typically responded quite positively when assessing the impacts of the program. Based upon the Year 2 survey data, the majority of BWLI teachers report that the program has resulted in:

- Improved quality of student work,
- Increased ability of students to work independently,
- Improved student engagement/interest level,
- Improved student motivation, and
- Improved student participation in class.

Moreover, a large majority of BWLI teachers reported that their own computer skills had improved as a result of their participation in the program, which has led to changes in how they deliver their lessons and to a changing school climate.

Year 2 finds widespread use of technology reported by students across all BWLI schools

Looking cumulatively across the Year 2 survey results, it is clear the majority of BWLI students used technology for at least some portion of every day during the second year of the projects implementation. Although some use was reported to occur in the school library and in labs, the majority of BWLI students' technology use was reported to be occurring in the classroom.

Year 2 finds widespread student use of technology across the core curriculum subjects

Despite a great deal of variability in the frequency of use across subject areas within most of the BWLI schools, students use of technology during the second year of the BWLI implementation was greater than pre-BWLI levels and student use at the comparison schools. Looking across the schools for subject area trends, we find that in three of the five BWLI schools, Math classes were the site of the least amount of technology use, while Social Studies was the site of the least frequent use in the other two BWLI schools. Similarly, no single subject area received universal high use at more than two schools, suggesting that factors within each school play a larger role in the adoption and student use of technology than factors related to individual subject areas. Specifically, when compared to the students in the two matched comparison schools, BWLI students typically reported using technology three to four times more frequently during the 2006–2007 school year.

Students reported using their laptops for a wide variety of educational purposes in school

BWLI students used technology across a wide variety of applications and with substantially greater frequency than students in the comparison schools. However, there was often substantial variation in the frequency of technology use across the five BWLI schools. By far, the most frequently reported technology use was using a computer "to find information on the Internet". Other frequent uses of technology in the 1:1 settings included using a computer to: "access a teacher's web site", "play computer games", "take notes in class" and "edit papers using a computer". Some of the least frequent in-school technology uses during the 2006–2007 school year included using a computer "take a test, quiz, or practice test", "work with spreadsheets/databases", and "send and receive email".

Student home access to computers during Year 2

Although there are small differences across each of the BWLI and comparison schools, students overwhelmingly reported that they had one or more computers available to them at their home.

Across all student survey respondents, only 5% of all survey respondents reported that they had no access to a computer at home. The majority of students with home access to technology reported high speed Internet access.

Percentage of students using BWLI laptops at home varied by school

During the second year of the BWLI implementation, 59% of all BWLI students reported that they "never" took a school computer home despite their participation in the 1:1 laptop program at their schools. Across the BWLI schools, there was substantial variation in the percent of students who reported bringing home a school computer with only 4% of Conte students reporting that they bring their BWLI laptop home "every day" compared to 74% of St. Mark students. About half of the students at Herberg, Reid, and St. Joe reported that they brought their laptops home with them "every day" during the 2006–2007 school year while the remaining half generally reported that they "never" brought a computer home from school.

Students home use of technology during Year 2

Students who reported having at least one computer at home (95% of all June 2007 respondents) also reported in the survey that they used their home computer approximately one hour per day, on average, although many students reported substantially more (or less) frequent technology use. For example, older students typically used their home computer more frequently then the younger students such that the frequency of home computer use increased as grade level increased. In addition, students across all schools reported that they generally used their home computers more frequently on days when they don't have school than on typical school days. Across nearly all schools, students reported they spent the most time using their home computer to "chat/instant message" with school averages reported between 45 and 55 minutes on a typical day. Students also reported frequent use of their home computer to "search the Internet for fun" and "play games". Students at the BWLI schools generally reported more time devoted to academic tasks on their home computer than students across the two comparison schools. Specifically, students in the BWLI settings reported somewhat more frequent use of their home computer to "write papers for school" and "search the Internet for school". Less frequent use was reported by students, on average, for using their home computer to "shop online", "create your own music or video projects", and "create or maintain web pages". Looking cumulatively across all the measured home technology uses, it is clear that many students are multi-tasking with their home computer time performing various tasks simultaneously, such as downloading an mp3 while chatting with friends and searching the Internet for fun or school.

Relationship between uses of technology and test performance

The current study presents a preliminary examination of the relationship between BWLI students and teachers use of technology in school and student performance on a state test of academic achievement. Specifically, results from the May 2007 MCAS administration were examined in the context of their relationship with technology use. The results of these analyses generally showed

that there were no major relationships between specific uses of technology in school during the 2006–2007 school year and students' May 2007 test performance. However, both the 7th grade and 8th grade results suggest the real possibility that the positive impacts that BWLI teachers have stated about the impact of the 1:1 laptop program on learning could be realized in later assessments or with a more sensitive test. For example, although the relationships are generally weak, nearly all measures of students subject specific technology use were positively correlated with MCAS results for BWLI respondents but were either less strong or negative for the comparison group students. It is expected that the final analyses using three years of cumulative survey and assessment data (including the inTASC computer writing exercise) will be able to provide a more definitive and detailed examination of the complicated relationship between students test performance and participation in the various components of the BWLI program.

Introduction

The current document is the second of three annual reports provided to the Massachusetts Technology Collaborative (MTC) by Boston College's Technology and Assessment Study Collaborative (inTASC) evaluation team. MTC provides oversight, on behalf of the Commonwealth, for state funding allocated to the Berkshire Wireless Learning Initiative (BWLI). Quarterly and annual reports are provided to the BWLI Steering Committee by inTASC at MTC's request in order to better assist the adoption of wireless learning technologies in participating schools.

At the time of this report (Spring 2008), each of the five BWLI middle schools is in the third and final scheduled year of BWLI implementation. In Years 2 and 3 of the project, students and teachers across all grade levels (6th through 8th) received laptop computers whereas only teachers and 7th grade students were provided laptops during the first year of deployment. In the current report, the researchers will first summarize the current status of the BWLI deployment as well as the current and projected status of the project evaluation. The report will then continue the examination of the BWLI and comparison group *teacher* survey results including a detailed summary of teachers' use of technology, the state technology standards, and professional development experiences. The report will then focus on the examination of the BWLI and comparison group *student* survey results including a detailed summary of students' use of technology across schools and over time. In addition, the current report also presents the first analyses on the preliminary data concerning the relationship between students' use of technology and student achievement as measured by the Spring 2007 Massachusetts Comprehensive Assessment System (MCAS).

Background

Few modern educational initiatives have been as widespread, dramatic, and costly as the integration of computer technologies into American classrooms. Believing that increased use of computers will lead to improved teaching and learning, greater efficiency, and the development of important skills in students, educational leaders have made multi-billion dollar investments in educational technologies such that the national ratio of students to computers has dropped from 125:1 in 1983 to 4:1 in 2002 (where it has largely remained) (Russell, Bebell, & Higgins, 2004). While access to computers has increased, teachers and students in traditional school environments generally report using computers in schools for only a small amount of time each day, with the least amount of use occurring in science and mathematics classes (Bebell, Russell, & O'Dwyer, 2004; Russell, Bebell, O'Dwyer, & O'Connor, 2003; Ravitz, Wong, & Becker, 1999). Despite the many ways in which computers can be distributed within schools (e.g., in labs, libraries, or on shared carts), some observers theorize that the disjuncture between the dramatic increase in the presence of computers in schools and the relatively stagnant amount of use results in part because student-to-computer ratios have not yet reached a stage at which the technology is ubiquitous (Bull, Bull, Garofolo, & Harris, 2002; Papert, 1996; Rockman, 1998).

Both proponents and opponents of educational technology agree that the full effects of technology in schools cannot be fully realized until the technology is no longer a shared resource

(Oppenheimer, 2003; Papert, 1992, 1996). Currently, a new educational reality has been emerging as thousands of students and teachers have been provided with their own laptop computers. Currently, Henrico County (VA) School District has implemented the fourth year of a district-wide 1:1 laptop program for grades 6 through 12 and the state of Maine recently renewed a second three-year contract for a state-wide laptop program which provides a laptop to each student and teacher for grades 7 and 8. In 2003–2004, it was estimated that 4% of the nations' school districts were implementing some form of 1:1 computing. Currently it is estimated that close to 25% of school districts are implementing some form of a 1:1 laptop program (eSchool News, 2006). Specifically, 1:1 programs now exist across the country in a wide variety of settings including large-scale 1:1 initiatives underway in South Dakota, Pennsylvania, New Hampshire, Texas, Georgia, Louisiana, California, Florida, Kansas, Massachusetts, and Michigan. In addition, international attention has been recently focused on the adoption of 1:1 computing through the "One Laptop Per Child" Initiative, which has recently launched a program to provide large quantities of $100 laptops to students in third world countries.

Prior research and evaluation studies suggest several positive outcomes from 1:1 laptop initiatives including: increased student engagement (Cromwell, 1999; Rockman, 1998; MEPRI, 2003), 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), and a movement towards student-centered classrooms (Rockman, 1998). Baldwin (1999) also documented effects on student behaviors at home such that students reported spending less time watching television and more time on homework. Similarly, Russell, Bebell and Higgins (2004) report that students' academic use of computers at home occurred more frequently when students were provided with their own laptops. In addition, an evaluation of the Maine laptop program (Silvernail & Lane, 2004) and of a laptop program in Andover, Massachusetts (Russell, Bebell, & Higgins, 2004) provide evidence that substantially more use of laptops is occurring in science and mathematics classes in comparison to what has been found in studies that focus on non-1:1 laptop settings (Ravitz, Wong, & Becker, 1999; Russell, O'Brien, Bebell, & O'Dwyer, 2003).

With these limited measures of success, 1:1 computing has recently captured the imagination of many educational and political leaders looking to reform educational practices and underperforming schools. In addition, a number of political leaders have suggested that providing students access to powerful and widespread technology will result in long term economic prosperity. In the last few years, a number of legislators and politicians have promoted 1:1 computing in various public school settings including a recent proposal from the Lieutenant Governor of Illinois to provide 170,000 7th graders across the state with laptops. Recently, in two months alone (June–July 2006), major state-funded investments in 1:1 laptop environments have been reported in South Dakota ($4 million), Pennsylvania ($20 million) and Massachusetts ($1.25 million). Within school settings, the promise of 1:1 computing has also taken root with nearly 50% of school district chief technology officers reporting in a recent national survey that were likely to purchase a computing device for each in their district by 2011 (Hayes, 2006).

However, despite growing interest in and excitement about 1:1 computing, there is a lack of sufficient, sustained, large-scale research/evaluation that focuses on teaching and learning in these intensive computing environments. This is lack of empirical research is particularly salient 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 No Child Left Behind.

A number of methodological and psychometric challenges have been partially responsible for this lack of research including (1) the way in which students' and teachers' technology use is measured, (2) a lack of prior student achievement measures or comparison groups, (3) a reliance exclusively on paper based tests in high-tech classroom environments, and (4) poor alignment of measurement tools[1]. The current study aims to recognize and overcome many of the prior methodological limitations and obstacles inherent in 1:1 laptop research.

The Berkshire Wireless Learning Initiative

The Berkshire Wireless Learning Initiative (BWLI) is a three-year pilot-program across five Massachusetts middle schools where every student and teacher has been provided a laptop computer. In addition, schools are equipped with wireless Internet networks, DLP and LCD projectors, as well as technical and curricular professional development and support to help teachers integrate the new technology into their curriculum. Each of the BWLI school districts were actively involved in the development of the 1:1 program, which resulted in their direct participation in the all phases of the program design and implementation.

The initiative is funded with a combination of school money, state money, and private sector fundraising. The fundraising portion of the project was completed in Fall 2007. The project currently has secured 100% of the overall $3,180,979 budget. Specifically, $1,040,650 has been raised through fundraising efforts in addition to the $240,329 provided by the participating schools and the $1,900,000 provided by the state.

Launched midway during the 2005–2006 school year, the initiative (as well as the accompanying research) is slated to continue through the 2007–2008 academic year.

As the first part of the program implementation, all teachers were provided with laptops in the late summer 2005 and have been regularly offered a variety of training and professional development opportunities. In early January 2006, each of the seventh grade students across the five participating schools (n=633) received Apple iBook G4 laptops for use during the remaining first year of the BWLI implementation. During this first year implementation, 7th grade students and teachers both reported substantial increases in the frequency and variety of technology use across the curriculum. In the second year of the laptop implementation all 6th, 7th, and 8th grade students across each BWLI school (n=1,700) were provided laptop computers for the majority of the 2006–2007 school year. Each participating BWLI school followed their own laptop deployment schedule, which is presented in Table 1.

Table 1: Student laptop deployment schedule for the 2006/2007 school year

	6th Grade	7th Grade	8th Grade
Conte School	Dec. 4	Nov. 10	Sep. 26
Herberg School	Dec. 7	Dec. 8	Oct. 13
Reid School	Dec. 11	Dec. 12	Oct. 26
St. Mark/St. Joe	Nov. 13	Nov. 13	Sep. 22

As shown above, all of the participating schools worked quickly to provide students with access to their laptop computers as early in the school year as was possible. In addition, like the prior year, the percent of students who were granted parent permission to take their BWLI laptops home was generally low and varies considerably across the participating schools.

Given that the BWLI is modeled as a pilot program funded partially by legislatures interested in 1:1 computing, an integral component of BWLI is the current three-year research study funded by the state ($200,000). At the time of this paper (March 2008), students across all BWLI schools are completing their third year of 1:1 computing, however, the current paper chiefly focuses on data collected during Years 1 and 2 of the program when the majority of 1,700 BWLI students and teachers were experiencing 1:1 computing for the first time. The following sections of the paper provide an overview of the research methodology, a summary of the project findings to date, and a discussion of these findings.

The results of Year 2 BWLI implementation are presented in the current report as well as the June 2007, September 2007, and December 2007 BWLI quarterly reports. The current paper focuses on summaries of students' computer use to date as well as preliminary analysis of the impact of computer use on students test performance.

Methodology

This study employs a pre/post study design to examine the effects of 1:1 technology on students and teachers across five public and parochial middle schools in Western Massachusetts. In other words, each student and teacher participating in the BWLI program is surveyed before they received a laptop and at various intervals throughout the program's implementation. In addition to following the cohorts by grade over three years of a 1:1 technology program, the researchers also collect comparison data from two neighboring public middle schools. A summary of the participating schools in the BWLI research study are displayed in Table 2:

Table 2: Summary of schools participating in the BWLI research

School Name	Classification	Grades	School Type
Conte School	BWLI	6, 7, 8	Public
Herberg School	BWLI	6, 7, 8	Public
Reid School	BWLI	6, 7, 8	Public
St. Mark	BWLI	K to 7	Parochial
St. Joe	BWLI	8, 9, 10, 11, 12	Parochial
North	Comparison	6, 7, 8	Public
South	Comparison	6, 7, 8	Public

Over the course of the three year study, the research team will use a series of teacher surveys, selected teacher interviews, student surveys, student drawings, analysis of existing school records, and qualitative classroom observations to document and track the impacts of 1:1 computing on teaching and classroom practices. Student achievement is measured through a secondary analysis of Massachusetts Comprehensive Assessment System (MCAS) test data in the three participating public BWLI schools and two comparison sites through a non-equivalent comparison group study. An additional student writing assessment was undertaken in January 2008 whereby students were randomly assigned to complete an extended writing exercise using their school laptop or using traditional paper and pencil. This writing assessment provides an opportunity to assess the impacts of the BWLI program on 7th grade students writing that may be missed using only paper-based writing assessment.

Data Sources and Response Rates

The current paper focuses on the first two years of a 1:1 student and teacher laptop implementation. As previously described, before the beginning of the 05-06 school year, teachers across all grade levels (6–8) were provided laptop computers as well as training and professional development on their basic functioning and curriculum integration. In addition, 7th grade students spent the first

months of the first school year (September 2005–December 2005) in a traditional learning environment but received laptops to use during the second half of the school year (January 2006). Finally, near the beginning Year 2 (October–December 2006) students across all grade levels received laptops for use during the school year. In the current document, the results of the first two years of the laptop initiative are summarized, although the majority of the students and teachers had only been in a 1:1 laptop setting for less than one school year at the last available date of data collection, in June 2007. Although the overall study of the BWLI program employed a wide variety of qualitative and quantitative data collection techniques (classroom observations, interviews, student drawings, etc.), space limitations focus the current paper primarily on the results of the student and teacher surveys. More thorough series of reports representing the full range of data sources can be accessed at www.bc.edu/bwli.

Student Survey

As more fully described in the BWLI evaluation plan (Bebell & Russell, 2005), all participating BWLI students completed a web based survey designed to focus on the frequency of many student technology uses both in and out of the classroom and across the curriculum. Students were additionally asked to report on the frequency of their teachers' use of technology across major curricular areas (Math, Reading/ELA, Social Studies, and Science) in addition to a handful of demographic items and a brief attitudes and beliefs inventory.

Given that the first year of the program focused on the seventh grade, grade seven students across the BWLI schools completed pre-1:1 laptop surveys in December 2005/January 2006. The overall response rate from the pre-laptop student survey was 574 surveys; or 86.6% of the 663 seventh grade students. After approximately five months of 1:1 computing, these 7th grade students completed a post-laptop survey in late May and early June 2006. Across the BWLI schools, the overall response rate from the student survey was 524 surveys, or 79% of the estimated seventh grade student population of 663 students. Table 3, below, shows the seventh grade student survey response rates for the pre and post laptop surveys.

Table 3: 7th grade student survey response rates

	# of 7th Grade Students	Survey Responses	Response Rate
Pre Survey (Dec. 2005/Jan. 2006)	663	574	86.6%
Post Survey (June 2006)	663	524	79.0%

In addition to the seventh grade students participating in the pre-post laptop surveys during the 2005–2006 school year, students from grades 6 and 8 completed pre-1:1 laptop surveys in May/June 2006. The overall response rate from all grades across the BWLI schools was 1,531 surveys, or 75.5% of the estimated student population of 2,028 students. Overall response rates varied somewhat across the schools with a range from 65.9% to 88.3%.

For the second year of the BWLI implementation, nearly every student across the five BWLI schools participated in the late May/June 2007 student survey in addition to students across the two comparison schools. The response rates from the May/June 2007 student survey is presented below in Table 4.

Table 4: Year 2 (May/June 2007) student survey response rate

School Name	Student Population	Survey Responses	Response Rate
South Middle School	626	552	88.2%
North Middle School	749	567	75.7%
Total Comparison Schools	**1375**	**1119**	**81.4%**
Conte Middle School	359	354	98.6%
Herberg Middle School	738	714	96.7%
Reid Middle School	646	622	96.3%
St. Mark	92	89	96.7%
St. Joe	63	60	95.2%
Total BWLI Schools	**1898**	**1839**	**96.8%**

A total of 1,119 students completed the survey from the two comparison schools yielding a combined response rate of 81.4%. The response rate was higher across the BWLI schools with 1839 out of 1898 students completing the survey resulting in a 96.8% response rate. Across the five BWLI schools, response rates ranged between 95.2% at St. Joe to 98.6% at Conte. Survey response rates in this range are remarkably high and represent the efforts of teachers, principals and administrators at each school. In addition, daily email updates were sent to school leaders containing lists of un-surveyed students and a web site was established where response rates could be monitored in real time for each school.

Teacher Survey

As more fully described in the BWLI Evaluation Plan (Bebell & Russell, 2005), every teacher participating in the BWLI program was to be surveyed prior to and during 1:1 student computing. To this end, seventh grade teachers across the four BWLI schools (as well as the two comparison group schools) were asked to complete pre-1:1 laptop surveys in January 2006 and post- 1:1 laptop surveys in May/June 2006 and May/June 2007. The online teacher survey focused on capturing the variety and extent of teachers' technology use, teachers' attitude toward technology, teaching, and learning, as well as teachers' beliefs on the effects of the BWLI program. The response rates from the May/June 2007 teacher survey is presented below in Table 5.

Table 5: Year 2 (May/June 2007) teacher survey response rate

School Name	Teacher Population	Survey Responses	Response Rate
South Middle School	68	42	61.8%
North Middle School	73	1	1.4%
Total Comparison Schools	**141**	**43**	**30.5%**
Conte Middle School	44	44	100%
Herberg Middle School	61	56	91.8%
Reid Middle School	55	52	94.5%
St. Mark	5	5	100%
St. Joe	3	3	100%
Total BWLI Schools	**168**	**160**	**95.2%**

A total of 43 teachers completed the survey from the two comparison schools yielding a combined response rate of 30.5%. Due to a scheduling conflict, North Middle School chose not to participate in the teacher survey, dramatically lowering the overall response rate for the comparison schools' teachers. Fortunately, the response rate was substantially higher across the BWLI schools with 160 out of 168 teachers completing the survey resulting in a 95.2% response rate. As with the students surveys, daily email updates were sent to school administrators which contained lists of un-surveyed teachers and a web site was established where response rates could be monitored in real time.

In the current report, results from the May 2007 teacher survey are compared to past survey administrations. Results from the January 2006 teacher survey again reflect a time when teachers had recently received their own laptops but no students had yet been issued computers. The May 2006 teacher survey administration asked teachers to focus on their first year experiences in the BWLI program with 7th grade students having had access to computers for the last five months of the year but still found 6th and 8th grade students without computers. It should be noted that the Year 1 teacher survey response rates were not generally very good, but focused on the 7th grade teach-

ers who were most involved with the first year of the project implementation. An overview of the number of teacher survey responses across BWLI schools and survey administration is presented below in Table 6.

Table 6: Number of teacher survey respondents by school and survey administration

School Name	Jan. 06	May 06	May 07	Total
Total Comparison Schools	**12**	**9**	**43**	**64**
Conte Middle School	20	9	44	73
Herberg Middle School	10	20	56	86
Reid Middle School		21	35	56
St. Mark/ St. Joe	3	3	8	14
Total BWLI Schools	**33**	**53**	**143**	**229**

Table 6 shows the total number of survey responses available for analyses in the tables and statistics which follow. As the table shows, fewer teachers responded to the teacher survey in its earlier administrations with only 33 BWLI responses from the January 2006 survey. A total of 53 BWLI school teachers were surveyed again in May 2006 after their 7th grade students had 1:1 access to laptop computers (May 2006). Lastly, teachers were surveyed a third time in May 2007 after the first year where students across all grade levels had access to laptop computers. As previously discussed, the May 2007 teacher survey boasted excellent response rates from the BWLI schools with a total of 143 BWLI responses and an additional 43 comparison school responses.

Due to the diligence and hard work of all participating schools, there was a great deal of empirical survey data collected from BWLI and comparison school students during the second year (2006–2007) of the BWLI program. (The second year of the laptop implementation program being the first full year when all grade levels of students actively participated in the initiative). The Year 2 student survey results thus represent the first empirical examinations of the impacts of school wide 1:1 computing in the five Berkshire schools. Given the excellent student and teacher response rates across all of the participating 1:1 schools as well as responses from over 1,100 neighboring students in two comparison middle schools, the current survey data provides an excellent snapshot of computer use and educational practices during the 2006–2007 school year.

Results

When examining the results of this interim data collection, it is particularly important to note that this document only represents a brief summary of the data collected concerning the early experiences of students and teachers in a 1:1 setting. These results present a 1:1 laptop initiative in its early adolescence and the tables and graphics presented herein should not be an indication of the overall success or failure of the BWLI goals but rather a snapshot of the program during its first full year of implementation across all grade levels. It has been postulated in the literature that the full impacts of any educational technology initiative may take many years to be realized. The current report focuses on data gathered during the first 18 months of a three-year pilot program.

Teacher Survey Results

Table T1 continues the exploration of BWLI teachers' adoption and use of technology since the beginning of the BWLI program with a summary of teachers' use of technology use collected from the January 2006, May 2006, and May 2007 survey administrations.

Table T1: BWLI Teachers' use of technology over time (measured by number of days per school year)

	Jan. 06	May 06	May 07
Use a computer to deliver instruction to your class	22.7	58.8	59.2
Prepare or maintain IEPs using a computer	17.0	9.0	18.4
Adapt an activity to students' individual needs using computers	13.2	32.2	28.2
Make handouts for students using a computer	51.6	50.8	60.7
Create a test, quiz, or assignment using a computer	49.0	46.8	56.0
Perform research and lesson planning using the Internet	56.9	73.9	80.6
Create WebQuests or build the Internet into a lesson	8.8	20.3	21.9
Use a computer to present information to your class	23.9	56.7	47.4
Use a computer to help students better understand a concept	23.6	50.2	45.2
Use a computer to model relationships	13.0	29.4	19.3
Create and/or maintain web pages	26.5	N/A	78.6
Assess students using a computer (including a test, quiz, or practice test)	24.1	N/A	43.6
Use a computer to communicate with teachers, parents, or administrators)	89.6	105.4	111.2

Table T1 shows BWLI teachers' reported use of educational technology over three survey administrations since January 2006 when only teachers had recently received laptops and no students had been provided laptops yet. For the majority of surveyed technology applications, teachers

reported a large increase in their use of technology during the last six months of the 2005–2006 school year. Comparing the January 2006 averages with the May 2006 averages, teachers' frequency of "preparing or maintaining IEPs using a computer", "making handouts for students using a computer" and "creating a test, quiz, or assignment using a computer" showed relatively small decreases while all other surveyed applications increased. For example, BWLI teachers reported that they had used a computer to deliver instruction to their class 22.7 days per year when surveyed in January 2006. Five months later, when 7th grade students now had access to laptop computers, teachers' frequency of delivering instruction using a computer increased to nearly 60 days per year, or once every three days during the 2005–2006 academic year. In the 2006–2007 school year, the frequency of computer use for the delivery of instruction increased nominally while many of teachers technology uses associated with lesson planning increased more substantially ("make handouts for students", "create a test, quiz, or assignment", "perform research and lesson planning using the Internet"). In addition, a number of instructional technology uses that were reported by teachers to increase in May 2006 then decreased somewhat during the 2006–2007 school year, including the use of a computer "to present information to your class", "help students better understand a concept", "model relationships and/or functions", and "create WebQuests or build the Internet into a lesson". Thus, over the first two years of the BWLI program, participating teachers generally reported substantial increases in all uses of educational technology.

Table T2, below, explores teachers technology use patterns during the 2006–2007 academic year and provides a summary of the frequency of teachers' average use of technology summarized across the BWLI schools and the comparison group schools.

Table T2: Frequency of teachers' use of technology during the 2006–2007 school year (May 2007, measured by number of days per school year)

	Comparison Schools	BWLI Schools	Mean Difference
Create and/or maintain web pages	10.0	78.6	68.6*
Use a computer to deliver instruction to your class	28.8	59.2	30.4*
Assess students using a computer (including a test, quiz, or practice test)	15.1	43.6	28.5*
Use a computer to help students better understand a concept	17.9	45.2	27.4*
Use a computer to present information to your class	22.8	47.4	24.6*
Perform research and lesson planning using the Internet	67.8	80.6	12.8
Create WebQuests or build the Internet into a lesson	11.7	21.9	10.2
Use a computer to model relationships and/or functions	9.7	19.3	9.5
Prepare or maintain IEPs using a computer	14.2	18.4	4.2
Adapt an activity to students' individual needs using computers	32.1	28.2	–4.0
Create a test, quiz, or assignment using a computer	66.9	56.0	–10.9
Make handouts for students using a computer	82.1	60.7	–21.4
Use a computer to communicate with teachers, parents, or administrators)	141.9	111.2	–30.8*

Note: * denote statistically significant differences (Unequal variances; p.<.05)

Table T2 shows the comparison of BWLI teachers' frequency of technology use to that of comparison school teachers during May 2007 survey administration. Overall, the average BWLI teacher used technology frequently for a wide variety of professional applications during the 2006–2007 school year, the second year of the BLWI implementation. Table T2 shows that for the 180 potential days in the academic year, BWLI teachers reported using a computer to communicate with teachers, parents, or administrators on 111 of those days. As widely reported in the literature, another frequent application of technology for teachers was "performing research and lesson planning using the Internet" which occurred about every other day, or 80.6 times across the 2006-2007 school year. Other frequently occurring uses cited by BWLI teachers included the use technology to "create and/or maintain web pages", "make handouts for students", "deliver instruction", and "create a test, quiz or assignment using a computer".

Comparing the averages of the BWLI teacher use with comparison teacher use found a number of statistically significant differences. In most categories of use the BWLI teachers reported more frequent technology use then the comparison teachers. The largest difference was found for "creating and/or maintaining web pages" which had occurred nearly every other day (78.6 times per

year) across the BWLI teachers and only 10 days per year for the comparison school teachers. Other statistically significant differences where BWLI teachers had used technology more frequently then the comparison school teachers during the 2006–2007 school year included: "delivering instruction", "assessing students using a computer", "helping students better understand a concept", and "presenting information to your class". Conversely, there were also a number of surveyed technology uses where the comparison group teachers reported more frequent technology use than the BWLI teachers in the May 2007 survey. "Adapting an activity to students' individual needs", "creating a test, quiz, or assignment", and "making handouts for students using a computer" all occurred somewhat more frequently, on average, for the comparison group teachers than the BWLI teacher respondents. However, a statistically significant difference was only observed for the "use of a computer to communicate with teachers, parents, or administrators" which occurred nearly 142 times during the 2006–2007 school year for the comparison school teachers compared to 111 times by the BWLI teachers.

Table T3 continues the exploration of the teacher technology use during the 2006–2007 school year by displaying the average frequency of a number of technology applications for teachers across the BWLI and comparison school.

Table T3: Frequency of teachers' use of technology during the 2006–2007 school year by school (May 2007 measured by number of days per school year)

	Comparison	Conte	Herberg	Reid	St. Mark/ St. Joe
Use a computer to deliver instruction to your class	**28.8**	64.2	58.9	57.3	41.6
Prepare or maintain IEPs using a computer	**14.2**	18.8	20.9	18.5	1.3
Adapt an activity to students' individual needs using computers	**32.1**	24.6	40.7	17.1	16.4
Make handouts for students using a computer	**82.1**	75.5	57.1	49.4	54.3
Create a test, quiz, or assignment using a computer	**66.9**	66.4	56.5	45.4	40.0
Perform research and lesson planning using the Internet	**67.8**	89.2	65.2	92.8	85.4
Create WebQuests or build the Internet into a lesson	**11.7**	29.4	19.2	19.2	9.3
Use a computer to present information to your class	**22.8**	44.7	50.1	46.1	49.1
Use a computer to help students better understand a concept	**17.9**	47.7	45.8	41.3	44.6
Use a computer to model relationships and/or functions	**9.7**	22.9	21.5	10.5	21.9
Create and/or maintain web pages	**10.0**	106.2	73.3	44.8	102.1
Assess students using a computer (including a test, quiz, or practice test)	**15.1**	4301	46.2	44.9	26.4
Use a computer to communicate with teachers, parents, or administrators)	**141.9**	106.9	137.0	97.5	8.6

Table T3 displays the comparison of BWLI teachers' frequency of technology use across each BWLI school to comparison school average frequencies during the 2006–2007 school year. Looking across the BWLI schools, patterns emerge showing which schools' teachers were using technology for what purposes during the second year of the BWLI implementation. For some technology applications, there was relatively little difference observed across the four BWLI schools. For example, the number of times teachers reported, on average, to "use a computer to present information to your class" occurred on average between 44 and 50 times for all BWLI schools compared to 22.8 times for the non-BWLI survey respondent. Similarly, the frequency with which teachers "use a computer to help students better understand a concept" occurred between 41 and 48 times per year across the BWLI schools while this activity occurred less than 18 times per year in the comparison schools. When looking across the BWLI schools at the other teacher technology applications, patterns of more frequent or less frequent use are found for individual schools. For example, the widest variation in teachers' frequency of technology use was observed for the "use of a computer to com-

municate with teachers, parents, or administrators" which was reported to occur 137 days per year by Herberg teachers but less than 10 days per year by the St. Mark/St. Joe teachers. Conte teachers reported the most frequent "use of a computer to deliver instruction to your class" which happened 64 times during the 2006–2007 school year compared to about 58 days a year in the Pittsfield public schools and 41.6 days at St. Mark/St. Joe's. Teachers' frequency of "creating and/or maintaining web pages" was greatest for the Conte and St. Mark/St. Joe teachers who performed this activity over 100 days during the 2006–2007 school year compared to 73 days at the Herberg school and 45 days at the Reid school.

Table T2 (page 17) shows that BWLI teachers typically used technology more frequently across a wide variety of reporting categories than teachers from the comparison school. Table T3, above, shows that there was often substantial variation in teachers' technology use patterns across the BWLI schools. Thus, after two years of the teacher laptop implementation and 1 year of school wide student implementation, there is clear evidence that teachers have adopted and maintain frequent and widespread uses of technology and computers in their teaching practice. However, the patterns of use vary across each school indicating that teachers and schools have implemented and applied the program to suit their own educational needs.

Previous research (as well as the BWLI classroom observation not presented here for space considerations) has shown the important role of the teacher in determining how and when students will use their laptops while in school. So, the teacher survey also asked teachers to reflect on how frequently they asked their students to create work and products using technology. Table T4, below, shows a comparison of the frequency with which BWLI teachers have assigned their students to create products using technology since the Jan. 2006 survey administration.

Table T4: Frequency of BWLI teachers' assignments of technology-based student products (times per school year)

	Jan. 06	May 06	May 07
Reports and term papers wit technology	2.89	12.2	16.1
Multimedia projects with technology	2.71	11.52	11.07
Web pages, web sites, or other web-based publications	2.04	13.14	10.83
Pictures or artwork with technology	4.15	6.76	14.22
Stories or books with technology	0.4	4.66	9.69
Graphs or charts with technology	5.54	7.3	10.79
Total	**17.73**	**55.58**	**72.7**

Table T4 displays the average frequency that BWLI teachers assigned their students to create products using technology during the three teacher survey administrations to date (January 2006, May 2006, and May 2007). Looking across all types of surveyed products, we see that there has been

a substantial and steady increase in the total frequency with which BWLI teachers assign their students to complete projects and create products using technology. Specifically, in the January 2006 survey, BWLI teachers reported having their students create products using technology on 17.7 occasions. Six months later, including the period that included the 7th grade student laptop deployment, BWLI teachers report a substantial increase with students creating products on 55.6 occasions during the 2006–2007 school year. By the end of the second year of the BWLI deployment (May 2007), teachers again reported an increase in the frequency of technology-enabled student products with the average BWLI teacher reporting that their students used technology to create products an estimated 72.7 over the 2006–2007 school year, a four-fold increase over the original January 2006 estimates. Based upon these findings, it is clear that, on average, BWLI teachers are having their students use technology with greater frequency in school and for a wide variety of purposes.

Looking at the individual list of student products, the greatest increases over time were reported for student creation of "reports and term papers" which went from under 3 instances a year in the January 2006 survey to over 16 times per year in May 2007. Between the May 2006 and the May 2007 survey, most uses of technology for student products continued to increase including the creation of "pictures or artwork", "stories or books", and "graphs or charts" using technology. However, across the BWLI teachers there were also some small decreases reported between the May 2006 and May 2007 frequencies. For example, students' use of technology to create "multimedia projects" and "web pages, web sites, or other web-based publications" has decreased slightly in the second year of the program (May 2007) compared to the May 2006 teacher survey results. This decrease, however small, is particularly interesting considering that nearly all students had access to individual laptops during the 2006–2007 school year while only 7th grade students had access to laptops when the May 2006 survey was completed by teachers.

Table T5: Comparison of BWLI and comparison teacher frequency of assigning students to create products using technology during the 2006–2007 school year (May 2007)

	Comparison Schools	BWLI Schools	Mean Difference
Web pages, web sites, or other web-based publications	1.5	10.8	9.3*
Multimedia projects with technology	2.5	11.1	8.5*
Pictures or artwork with technology	7.1	14.2	7.1
Reports and term papers wit technology	9.8	16.1	6.3
Graphs or charts with technology	6.4	10.8	4.4
Stories or books with technology	6.3	9.7	3.4

Note: * denote statistically significant differences (Unequal variances; p.<.05)

Table T5 displays a comparison of the frequency which BWLI and comparison teachers assigned their students to create products using technology during the 2006–2007 school year. In the May 2007 survey teachers were asked to reflect on the past year and to estimate the number of times they had asked their students to produce various products using technology. Overall, the average BWLI teachers more regularly required their students to produce products using technology during the 2006–2007 school year, the second year of the BLWI implementation. Table T5 shows that for the 180 potential days in the 2006–2007 academic year, BWLI teachers reported having their students use technology to create a product on 72.7 occasions, compared to 33.7 times in the comparison schools. The most frequent products assigned by BWLI teachers for their students to complete using technology were "reports and term papers" (16.1 times per year) and "pictures or artwork" (14.2 times per year).

Comparing the averages of the BWLI teachers with comparison teachers across each of the different student uses revealed two statistically significant differences: "web pages, web sites, or other web-based publications" and "multimedia projects with technology" although BWLI teachers more frequently required their students to create products using technology across all surveyed categories. Table T6 continues the exploration of the teacher technology use during the 2006–2007 school year by displaying BWLI and comparison teachers' frequency of assigning students to create products using technology across the BWLI and comparison schools.

Table T6: Frequency of teachers' assignments of technology-based student products during the 2006–2007 school year by school (May 2007)

	Comparison	Conte	Herberg	Reid	St. Mark/ St. Joe
Reports and term papers with technology	**9.8**	12.0	24.7	10.1	9.3
Multimedia projects with technology	**2.5**	15.9	11.1	5.3	9.0
Web pages, web sites, or other web-based publications	**1.5**	18.2	9.8	2.4	10.9
Pictures or artwork with technology	**7.1**	13.2	17.3	12.9	7.7
Stories or books with technology	**6.3**	12.1	8.2	9.1	8.5
Graphs or charts with technology	**6.4**	13.7	10.7	8.8	4.1

Table T6 shows the average frequency across each of the BWLI schools for how often teachers assigned their students to create products using technology during the 2006–2007 school year. Based upon the May 2007 survey results, patterns of different technology are evident across the different BWLI schools. Overall, when the variety of student products are summed, Conte and Herberg teachers reported the most frequent use of technology by students to create products while Reid and St. Mark/Joe reported the least frequent use. It is notable that there is a nearly two-fold difference in the overall frequency with which students use technology to create products between the Conte and Herberg students and students at Reid and St. Mark/St. Joe.

Looking across the individual student products, a number of interesting use patterns emerge. For example, Herberg teachers reported over twice the frequency of assigning their students "reports and term papers with technology" than at any other BWLI school. Similarly, Conte teachers reported assigning their students to create and work on "web pages, web sites, or other web-based publications" nearly twice as frequently as teachers in the other BWLI schools. Conversely, Reid teachers reported very rarely having their students use technology to create and work on "web pages, web sites, or other web-based publications" and "multimedia projects with technology". Despite these variations across the BWLI schools, BWLI teachers nearly always reported more frequent use of technology by students for products than those teachers surveyed at the comparison school.

Massachusetts Technology Standards

In the teacher survey, BWLI teachers were asked to reflect upon their familiarity with the Massachusetts PreK-12 Instructional Technology Standards for students. In addition, teachers were asked to reflect on the percentage of their students that they believe are meeting the state standards. Table T7, below, shows the percent of teachers who reported familiarity with MA Instructional Technology Standards on the May 2007 teacher survey.

Table T7: Percent of teachers who reported familiarity with the MA PreK–12 Instructional Technology Standards (May 2007)

	Mean	*SD*	n
Comparison	52%	**0.51**	42
Conte	86%	**035**	44
Herberg	57%	**0.50**	56
Reid	26%	**0.44**	35
St. Mark/St. Joe	83%	**0.41**	6

Table T7 shows the summary statistics for the percent of teachers who reported familiarity with the Massachusetts PreK-12 Instructional Technology Standards. In the May 2007 teacher survey, all teachers were asked: "Are you familiar with the Massachusetts PreK-12 Instructional Technol-

ogy Standards?" The above table summarizes the results of this question and displays the mean, (or average), the standard deviation, and the number of teacher respondents across each of the BWLI schools as well as the comparison school. The average percent of teachers who acknowledged their familiarity with the state technology standards varied substantially across the BWLI teachers. The mean varied across the schools with 86% of Conte teachers reporting familiarity with the state standards while only 26% of Reid teachers reported familiarity. Herberg teachers most resembled the comparison school teachers with just over half (57%) of the staff reporting familiarity with the standards. Of the 42 comparison school teachers who completed the survey, 52% reported familiarity with the state technology standards. Despite not working within a public school, 83% of St. Mark's and St. Joe's six BWLI teachers reported familiarity with the standards.

The standard deviation is also reported in Table T7, which provides an estimate of how divergent the teacher responses were across each school on the May 2007 survey. In other words, the larger the reported standard deviation, the greater the variation in teachers' reported familiarity of standards when the survey was completed in May 2007. Teachers' familiarity with the standards is further investigated in Table T8, which examines the percent of BWLI teachers who reported familiarity with the state's student technology standards at different intervals since the beginning of the student computer deployment in January 2006.

Table T8: Percentage of students familiar with MA Technology Standards over time for BWLI

Are you familiar with the MA PreK–12 Instructional Technology Standards?	
January 2006	28%
May 2006	54%
May 2007	60%

Table T8 shows the percentage of BWLI teachers familiar with the Massachusetts Technology standards across three separate teacher survey administrations. When teachers were first surveyed in January 2006 (before any students had been provided laptops) only 28% of respondents reported being familiar with the Massachusetts Technology Standards. By the end of Year 1 (May 2006), 54% of teachers across the BWLI schools reported to be familiar with the Massachusetts Technology Standards. By the end of Year 2 (May 2007) (which included all grade levels' students participating in the 1:1 deployment) 60% of BWLI teachers reported to be familiar with the standards.

For those BWLI teachers who reported familiarity with the Massachusetts state technology standards, the survey further prompted them to estimate the percentage of their students who had mastered the technology standards for their level. Table T9, next page, displays the summary statistics for the percent of students who have mastered the state technology standards across the BWLI and comparison schools at the end of Year 2.

Table T9: Teachers' estimate for the percent of students who have mastered technology standards (May 2007)

	Mean	*SD*	n
Comparison	53.7%	**24**	19
Conte	59.6%	**23**	12
Herberg	58.0%	**27**	33
Reid	41.4%	**38**	13
St. Mark/St. Joe	70.6%	**15**	5

Table T9 shows the summary statistics for the percent of students who have mastered the state technology standards across the BWLI and comparison schools at the end of Year 2. Across the BWLI schools, St. Mark/St. Joe teachers reported the highest percentage of student mastery of the MA technology standards (70.6%) while Conte and Herberg teachers followed with student mastery estimated at 59.6% and 58%, respectively. Reid teachers reported the lowest percentage with only 41.4% having mastery of the technology standards which was less than the non-1:1 comparison group teachers who estimated that 53.7% of their students have mastered the standards.

The percentage of BWLI students who have mastered the state technology standards based on the teacher survey responses are further explored in Table T10, below, with the mean results from the past three teacher survey administrations.

Table T10: Percent of BWLI teachers who report their students have mastered technology standards since January 2006

Estimate the percentage of students you taught during the 05–06 school year who mastered the technology standards for their level?	
January 2006	25%
May 2006	48%
May 2007	56%

Table T10 shows teachers' estimated percentage of BWLI students who have mastered the Massachusetts State Technology Standards since January 2006. When teachers were first surveyed in Jan 2006 (again, before any students had been provided laptops) teachers estimated that only 25% of their students had mastered the Massachusetts technology standards. By the end of Year 1 (May 2006), teachers estimated that 48% of the BWLI students had mastered the technology standards. Thus, there was a major increase of students who had mastered the standards in the last half of the 2005–2006 school year coinciding with the 7th graders being provided laptops. However, by the end of Year 2 (May 2007) (which included all grade levels participating in the 1:1 deployment) the

percent of students who were reported to have mastered the standards rose less substantially to 56%.

Teachers' Professional Development Participation and Satisfaction

In addition to documenting teachers' use of technology and teachers' familiarity with the state technology standards, the teacher survey also asked teachers to reflect on their experiences with BWLI professional development. Table T11 begins the exploration of teachers' participation and satisfaction and shows a summary of BWLI teachers' professional development application during the 2006–2007 school year.

Table T11: Percent of applied BWLI professional development by school (May 2007)

"What percentage of the BWLI professional development have you been able to apply in your classroom or teaching?"		
Conte	Mean	60.8%
	N	**40**
	SD	33.0
Herberg	Mean	50.9%
	N	**46**
	SD	30.2
Reid	Mean	41.3%
	N	**31**
	SD	26.3
St. Mark/St. Joe	Mean	53.7%
	N	**7**
	SD	32.9

Table T11 shows the summary statistics for the BWLI teachers May 2007 survey question "'*What percentage of the BWLI professional development have you been able to apply in your classroom or teaching?*" Specifically, the mean (or average), standard deviation (measure of the response variability), and the number of responding teachers are reported for each BWLI school. Across the BWLI schools, Conte teachers reported the highest percent of applicable professional development (60.8%) followed by St. Mark/St. Joe teachers with 53.7%. The Pittsfield public school teachers reported the lowest percentage of applied professional development with school averages of 50.9% for Herberg and 41.3% for Reid teachers. The standard deviation provides an estimate for how spread out teachers' responses were at each school. For example, there was less variation in teachers' response at Reid as indicated by the standard deviation of 26.3 compared to Conte teachers who

had the most variability with a standard deviation of 33.0. Table T12, below, continues the examination of how much BWLI professional development was applied by BWLI teachers since the project's beginnings in January 2006.

Table T12: Percent of applied BWLI professional development across survey administrations; *'What percentage of the BWLI professional development have you been able to apply in your classroom or teaching?'*

Date	Mean	N	Standard Deviation
January 2006	35.6	29	31.3
May 2006	51.0	47	33.0
May 2007	51.9	124	30.9

Table T12 shows the percentage of BWLI professional development teachers have applied in their classroom or teaching over three different survey administrations. As expected, the January 2006 teacher survey had the lowest percentage of applied professional development (35.6%), likely due to the fact that students had not yet received laptops yet. By the end of Year 1 (May 2006), 7th grade students had access to laptops and the percent of applied professional development increased to 51% across all BWLI teachers. However, the difference between the Year 1 results and Year 2 are negligible despite the fact that now all teachers across all grade levels were teaching in a 1:1 setting throughout the majority of 2006–2007 school year. Professional development remains an important characteristic of the BWLI and expanded efforts to include more teachers in a variety if professional development is currently underway for the third year of deployment. It should be noted that one potential reason for the lack of application of professional development could be the characteristic of the May 2006 respondents where less than 50% of the all staff completed the survey.

Table T13, next page, shows the teachers' professional development participation rates across the BWLI schools for the second year of the BWLI implementation.

Table T13: Year 2 Technology related professional development participation across all schools (May 2007)

	Comparison	Conte	Herberg	Reid	St. Mark/ St. Joe
"During the 06–07 school year, how many hours of technology professional development did you complete?"	**5.08**	**20.53**	**17.13**	**10.86**	**22.5**
Technology PD Participation: Formal BWLI Professional Development sessions	N/A	2.03	1.28	0.96	0.17
Technology PD Participation: Informal BWLI Professional Development sessions	N/A	3.1	1.98	1.88	1
Technology PD Participation: Workshops and seminars run by school district personnel	0.94	3.02	2.18	2.09	0
Technology PD Participation: Workshops and seminars run by Apple	N/A	0.55	0.3	0.04	1.43
Technology PD Participation: Workshops and seminars run by BWLI staff	N/A	1.39	1.23	0.62	0.25
Technology PD Participation: Conferences related to education technology	0.28	0.8	0.7	0.5	0
Technology PD Participation: Release time for individual professional development related to technology	0.31	0.74	0.86	0.24	1.71
Technology PD Participation: Release time for department, BWLI, or grade level planning related to technology	0.31	0.9	0.83	0.4	0.86
Technology PD Participation: Online or web-based technology related to professional development	0.66	0.68	1	1.13	1.14
Technology PD Participation: Professional Development focusing on curriculum integration (Model Lesson, etc.)	1.31	1.9	1.84	1.69	0.63

Table T13 compares the average frequency that teachers participated in educational technology professional development during the 2006–2007 school year. Table T13 also shows the average number of hours teachers participated in technology related professional development during the 2006/2007 across each school year (in bold). Given the central role that professional development plays in the BWLI initiative, it is not surprising to find that BWLI teachers reported participating in substantially more professional development related to educational technology than the comparison group teachers. However, there was also substantial variation in teachers' participation rates across the BWLI schools. For example, Conte and St. Mark/St. Joe teachers reported participating

in more than 20 hours of professional development over the school year compared to 16.8 hours, on average for Herberg teachers and 10.9 hours for Reid teachers. It should be noted that the analyses also showed a great deal of variation *within* each of the BWLI schools indicating that all teachers within a school were not participating equally in the professional development opportunities.

The remaining data in Table T13 show the frequency of teachers' participation across a wide variety of different educational technology professional development categories. It should be noted that several questions were not asked of comparison group teachers as they concerned professional development experiences that were specific to the BWLI program. Table T14 shows BWLI teachers' participation in various professional development experiences since January 2006.

Table T14: BWLI professional development participation over time

	Jan. 2006	May 2006	May 2007
	Mean	Mean	Mean
Technology PD Participation: Formal BWLI Professional Development sessions	2.26	2.09	1.4
Technology PD Participation: Informal BWLI Professional Development sessions	2.74	1.67	2.28
Technology PD Participation: Workshops and seminars run by school district personnel	3.41	3.06	2.33
Technology PD Participation: Workshops and seminars run by Apple	1.23	0.8	0.4
Technology PD Participation: Workshops and seminars run by BWLI staff	2.68	1.52	1.09
Technology PD Participation: Conferences related to education technology	0.6	0.66	0.66
Technology PD Participation: Release time for individual professional development related to technology	1.71	0.78	0.74
Technology PD Participation: Release time for department, BWLI, or grade level planning related to technology	1.21	0.55	0.76
Technology PD Participation: Online or web-based technology related to professional development	0.5	1.1	0.93
Technology PD Participation: Professional Development focusing on curriculum integration (Model Lesson, etc.)	2.52	2.08	1.75.

Table T14 shows BWLI teacher participation rates for a variety of technology-related professional development across three administrations of the teacher survey (January 2006, May 2006, and May 2007). Looking across the three survey administrations, the amount of time teachers report participating in technology-related professional development has generally declined since the January 2006 survey. Amongst the most frequently attended professional development experiences for BWLI teachers during the 2006–2007 school year was "workshops and seminars run by school district personnel" and "informal BWLI professional development".

Based upon the results in Table T13 and T14, it is clear that professional development participation varies both across and within the BWLI schools. In general, the frequency with which teachers report participating in technology-related professional development has decreased. This could be attributed to the large influx of technology-related professional development at the beginning of the BWLI implementation as reflected by the January 2006 survey or by any number of other considerations. In addition to the frequency of teachers' professional development participation, the teacher survey also asked teachers to reflect on their satisfaction level with the technology related professional development they had received during the 2006–2007 school year. These results are presented across the BWLI schools in Table T15, next page.

Table T15: Year 2 professional development satisfaction by school (May 2007)

	Conte	Herberg	Reid	St. Mark/ St. Joe
Technology PD Satisfaction: Formal BWLI Professional Development sessions	2.2	2.09	2.07	1.75
Technology PD Satisfaction: Informal BWLI Professional Development sessions	2.47	2.36	2.26	2.33
Technology PD Satisfaction: Workshops and seminars run by school district personnel	2.38	2.42	2.18	1
Technology PD Satisfaction: Workshops and seminars run by Apple	2.06	2.07	2.5	3
Technology PD Satisfaction: Workshops and seminars run by BWLI staff	2.43	2.27	2.18	2
Technology PD Satisfaction: Conferences related to education technology	2.17	2.19	2.43	
Technology PD Satisfaction: Release time for individual professional development related to technology	2.23	2.29	2.67	3
Technology PD Satisfaction: Release time for department, BWLI, or grade level planning related to technology	2.17	2.17	2.25	3
Technology PD Satisfaction: Online or web-based technology related to professional development	2.25	2.28	2.5	2.75
Technology PD Satisfaction: Professional Development focusing on curriculum integration (Model Lesson, etc.)	2.41	2.5	2.53	3

Scale: 1 = Not very satisfied; 2 = Somewhat satisfied; 3 = Very satisfied

Table T15 shows BWLI teachers' average level of satisfaction with a variety of technology-related professional development that they had personally participated in during the 2006–2007 school year. Teacher satisfaction was measured with a 3 point scale where larger numbers correspond to greater degrees of satisfaction (3 = very satisfied, 2 = somewhat satisfied, 1 = not very satisfied). Overall, teachers across BWLI schools appear fairly satisfied with the professional development experiences they have participated in as evidenced by only two responses less than 2 (or somewhat satisfied). Only teacher respondents at St. Mark/St. Joe reported an average rating of less than 2 for two categories of professional development during the 2006–2007 school year: "workshops and seminars run by

school district personnel" and "formal BWLI professional development sessions". Table T16 shows BWLI teachers' satisfaction with technology-related professional development since January 2006.

Table T16: BWLI professional development satisfaction over time

	Jan. 2006	May 2006	May 2007
	Mean	Mean	Mean
Technology PD Satisfaction: Formal BWLI Professional Development sessions	2.21	2.29	2.11
Technology PD Satisfaction: Informal BWLI Professional Development sessions	2.62	2.41	2.38
Technology PD Satisfaction: Workshops and seminars run by school district personnel	2.2	2.36	2.33
Technology PD Satisfaction: Workshops and seminars run by Apple	2.36	1.9	2.17
Technology PD Satisfaction: Workshops and seminars run by BWLI staff	2.36	2.22	2.31
Technology PD Satisfaction: Conferences related to education technology	1.89	2.05	2.22
Technology PD Satisfaction: Release time for individual professional development related to technology	2	2.06	2.33
Technology PD Satisfaction: Release time for department, BWLI, or grade level planning related to technology	2.2	2.07	2.21
Technology PD Satisfaction: Online or web-based technology related to professional development	2	2.08	2.36
Technology PD Satisfaction: Professional Development focusing on curriculum integration (Model Lesson, etc.)	2.22	2.1	2.5

Scale: 1 = Not very satisfied; 2 = Somewhat satisfied; 3 = Very satisfied

Table T16 shows BWLI teachers' average level of satisfaction with a variety of technology-related professional development across three administrations of the teacher survey (January 2006, May 2006, and May 2007). Again, teacher satisfaction was measured with a 3 point scale where larger numbers correspond to greater degrees of satisfaction (3 = very satisfied, 2 = somewhat satisfied, 1 = not very satisfied). Looking across the three survey administrations, teachers' satisfaction with their professional development experiences has changed relatively little since the January 2006 survey.

Teacher Perceptions Across All BWLI Teachers

The following tables contain the preliminary survey results from a series of questions addressing teachers' perceptions on the effects of 1:1 computing across a variety of different student and classroom characteristics. This new series of survey questions was included in the Year 2 teacher survey to further query the teachers on their perceived effects of the 1:1 technology. Specifically, questions were included to show if teachers felt that the BWLI program was significantly impacting how teachers conduct their classes and how students of different ability levels are learning with the new technology. Teachers were presented with twelve Likert response items (Strongly Agree, Agree, Neutral, Disagree, Strongly Disagree) that addressed specific changes in their beliefs, practices and abilities since the adoption of the 1:1 program. In addition, teachers were also presented with a list of 14 types of student behaviors, attitudes and activities and were asked to rate how such actions have changed (Declined, No Effect, Improved) since the laptop program was first launched. Teachers were asked to focus the responses to these survey items based on specific groups of students. These groups included:

- high achieving students,
- at-risk or low-achieving students, and
- traditional students

Nearly all of the items used in this section of the survey were adapted from the 1:1 teacher survey used in the Piscataquis Community High School Study (Great Maine Schools Project, 2004) and were also applied in the evaluation of New Hampshire's pilot 1:1 laptop program, Technology Promoting Student Excellence (TPSE, 2005).

The following results detail the data collected via a web-based survey in May/June 2007 from 160 surveyed teachers across the five BWLI schools focusing specifically on their beliefs and experiences having taught in a 1:1 laptop setting. First, Figure T1 illustrates the results of series of Likert-scaled items presented to the BWLI teachers regarding teachers' beliefs and experiences in the BWLI.

Figure T1: Frequencies of Year 2 BWLI teacher beliefs (May/June 2007)

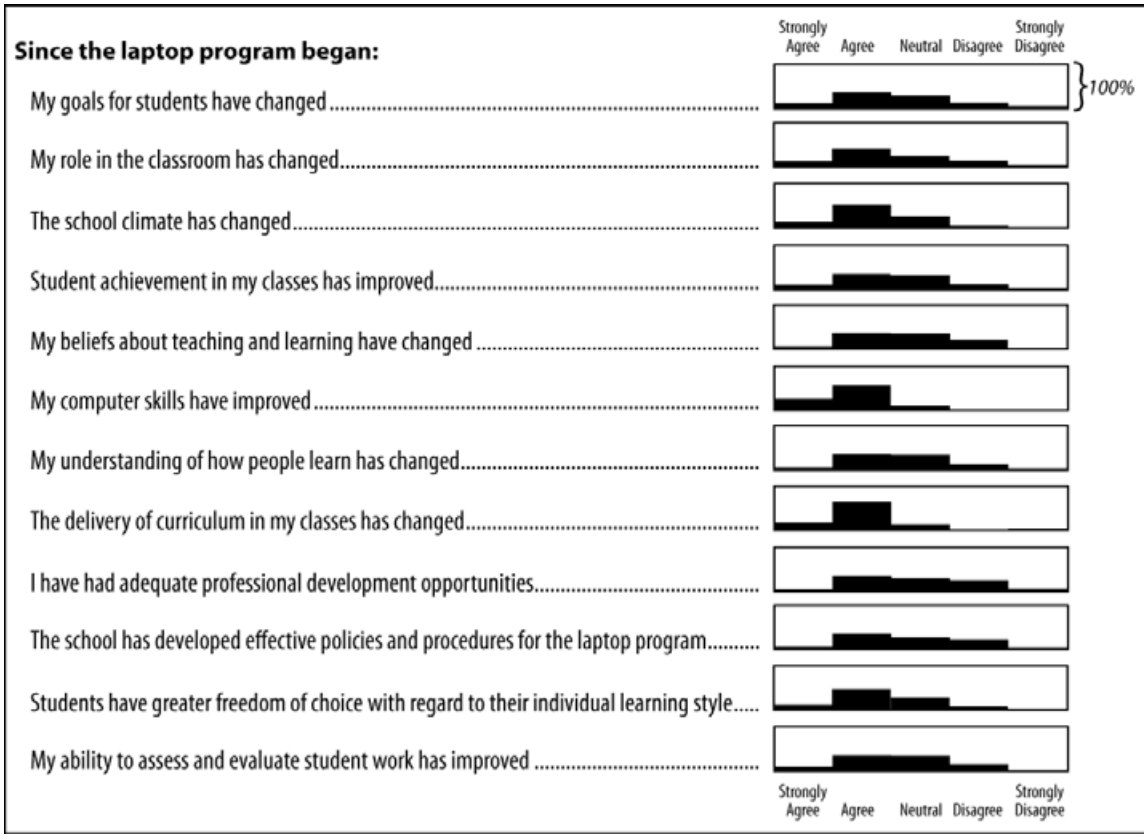


Figure T1 shows twelve survey items and teachers' average responses ranked from most agreement to least agreement (top to bottom). As Figure T1 illustrates, participating teachers were generally quite positive toward their experiences and beliefs regarding the impacts of the BWLI program and 1:1 computing. Nearly all of responding teachers (86%) "strongly agreed" or "agreed" that their personal computer skills had improved since the beginning of the BWLI program. In addition, the teachers noted overwhelmingly that the school culture and environment has been affected by the program. Specifically, over 60% of responding teachers "strongly agreed" or "agreed" that the school climate had changed and over 50% of teachers believed that their role as a teacher within their own classroom had changed. In addition, over 80% of the 160 responding teachers reported that the delivery of curriculum within their classes had changed since their school began the BWLI program. Many BWLI teachers also reported a personal shift in their own beliefs about teaching while nearly 50% of teachers reported that their understanding of how people learn had also changed (approximately 18% "disagreed" or "strongly disagreed" while 36% responded "neutral"). Many teachers reported that they felt the new technology was a benefit for students with over 45% of respondents specifically reporting that they felt student achievement had improved (approximately 15% "disagreed" or "strongly disagreed" while 35% responded "neutral"). Similarly, over 60% of teacher respondents stated that their students now have "greater freedom of choice with regard to their

individual learning style." Teachers provided mixed sentiments concerning some implementation aspects of the BWLI program with nearly 45% of teachers stating that their "school had developed effective policies and procedures for the laptop program" while approximately 28% "disagreed" or "strongly disagreed" and 27% of teachers responded "neutral". Also demonstrating a wide range of teacher sentiment, about 40% of teachers "agreed" or "strongly agreed" with the statement that they had been provided with "adequate professional development opportunities" while about 30% of teachers "disagreed" or "strongly disagreed."

Teacher Perceptions Across Grade Levels

In addition to looking, as a whole, at the entire BWLI teacher population, the teacher beliefs survey data was also examined across each of the individual grade levels (6th, 7th and 8th). Table T17, below, shows the mean responses of Year 2 BWLI teacher beliefs across grade level.

Table T17: Mean of Year 2 BWLI teacher beliefs across grade levels

	6th Grade	7th Grade	8th Grade
I have had adequate professional development opportunities	3.1	3.2	3.1
My beliefs about teaching and learning have changed	3.3	3.4	3.1
My understanding of how people learn has changed	3.3	3.4	3.2
The school has developed effective policies and procedures for the laptop program	3.4	3.3	3.1
My goals for students have changed	3.5	3.4	3.3
My ability to assess and evaluate student work has improved	3.5	3.5	3.4
Student achievement in my class has improved	3.6	3.5	3.4
My role in the classroom has changed	3.6	3.4	3.4
Students have greater freedom of choice with regard to their individual learning style	3.7	3.7	3.6
The school climate has changed	3.7	3.6	3.5
The delivery of curriculum in my classes has changed	4.0	4.0	3.8
My computer skills have improved	4.1	4.1	4.0

Scale: 5 = Strongly agree; 4 = Agree; 3 = Neutral; 2 = Disagree; 1 = Strongly disagree

As Table T17 illustrates, there was little variation observed across the different grade levels. At the time of the survey, seventh grade teachers had the most experience teaching in 1:1 settings although rarely do their responses differ much, if at all, from their 6th and 8th grade peers.

Teacher Perceptions Across Schools

As past analyses have shown differences in teacher practices across the BWLI schools, we also explored teacher attitudes across each of the BWLI schools in Table T18, below.

Table T18: Mean of Year 2 BWLI teacher beliefs across schools

	Conte	Herberg	Reid	St. Mark/ St. Joe
I have had adequate professional development opportunities	3.4	2.9	2.9	2.6
The school has developed effective policies and procedures for the laptop program	3.7	3.2	2.6	4.1
My understanding of how people learn has changed	3.5	3.4	3.0	3.9
My beliefs about teaching and learning have changed	3.4	3.4	3.0	4.0
My ability to assess and evaluate student work has improved	3.4	3.6	3.2	3.8
My goals for students have changed	3.4	3.5	3.2	3.9
My role in the classroom has changed	3.6	3.5	3.3	3.6
Student achievement in my class has improved	3.5	3.5	3.2	4.1
The school climate has changed	3.7	3.7	3.5	4.0
Students have greater freedom of choice with regard to their individual learning style	3.9	3.6	3.3	4.1
The delivery of curriculum in my classes has changed	4.0	4.0	3.9	4.1
My computer skills have improved	4.2	4.2	3.9	4.1

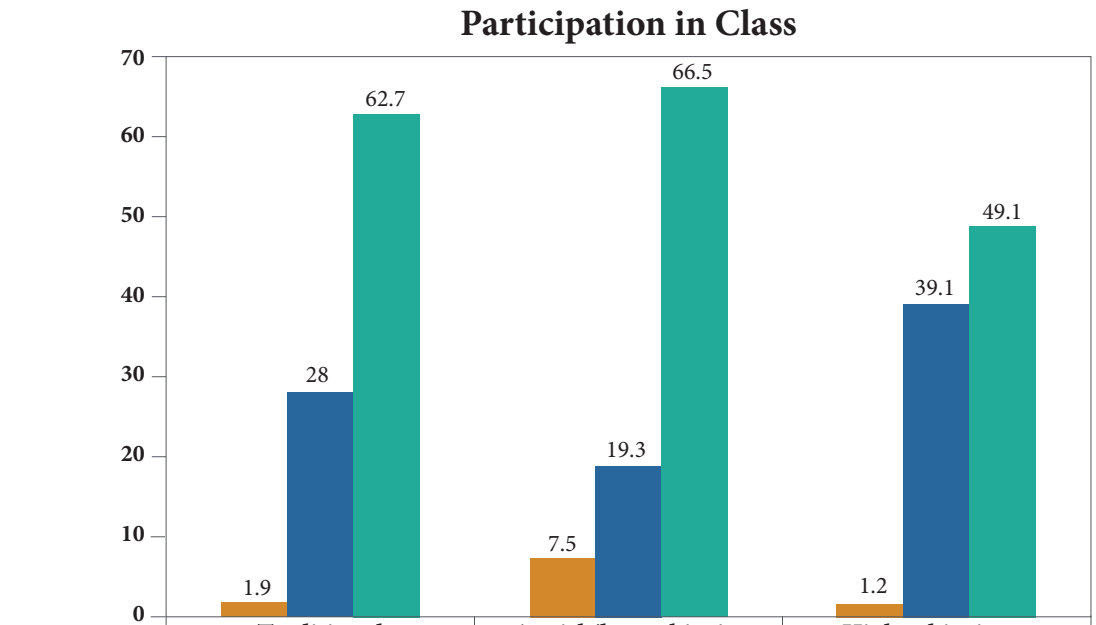
Scale: 5 = Strongly agree; 4 = Agree; 3 = Neutral; 2 = Disagree; 1 = Strongly disagree

As illustrated by Table T18, there was somewhat more variation in teachers' beliefs and attitudes across the BWLI schools than there was across grade levels (Table T17). In general, teachers at the Reid school reacted somewhat less positively than teachers at the other schools to many of the survey questions. In contrast, teachers from St. Mark and St. Joe (combined here due to the small number of parochial teachers) generally reported more positively, on average, on the impacts of the 1:1 technology program. For example, St. Mark/Joe teachers averaged 4.1 for the survey item "student achievement has improved" compared to 3.5 for the Conte and Herberg teachers and 3.2 for the Reid teachers.

Concerning aspects of the program itself, there were many cases where the teacher sentiment varied across the participating schools. For example, teacher responses to the item *"the school has developed effective policies and procedures for the laptop program"* varied across each of the BWLI schools. Specifically, St. Mark/Joe teachers reported nearly 90% agreement while over 50% of Reid teachers disagreed with the same statement. Similarly, Conte teachers were more favorable of the professional development opportunities they have been provided (3.4) compared with Herberg (2.9), Reid (2.9), and St. Mark/Joe (2.6). Other survey items that exhibited notable differences across the schools included *"My beliefs about teaching and learning have changed"* and *"My understanding of how people learn has changed."*

Additional survey items were added this year to the teacher survey that asked teachers to consider how the 1:1 program was effecting specific populations of students. Fourteen questions asked teachers to consider how the BWLI program had specifically impacted their traditional, at-risk/low-achieving, and high-achieving students. The results reported below are averaged from all of the 160 BWLI teacher survey respondents. However, not every teacher answered every survey question. The careful reader will note that the percentages reported below in Figures T2 through T15 do not always add to 100% as between 5-10% of the teacher respondents did not answer each of the given questions. Thus, the percentages reported in the following graphs reflect the full sample, which includes even those teachers who chose not answer a given question.

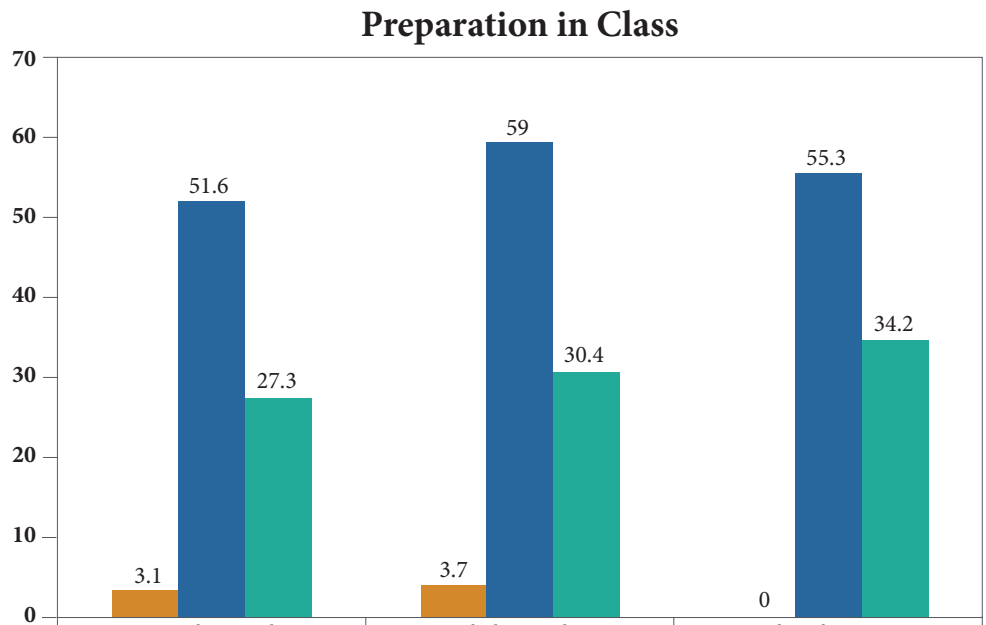
Figure T2: Teachers' beliefs on the impact of 1:1 computing on students' participation in class



	Traditional students	At-risk/low achieving students	High achieving students
Declined	1.9	7.5	1.2
No Effect	28	19.3	39.1
Improved	62.7	66.5	49.1

Figure T2 illustrates teachers' beliefs on the impact of 1:1 computing on student's participation in class. Across all types of students, the majority of teachers generally found that the BWLI program improved student participation in class. The most improved category was greatest for at risk/low achieving students with 66.5% of all responding teachers reporting an improvement in class participation compared to 62.7% for traditional students and 49.1.5% for high achieving students. A small number of teachers (7.5% of all respondents) believed that the 1:1 laptops had led to declined class participation for their at risk/low achieving students.

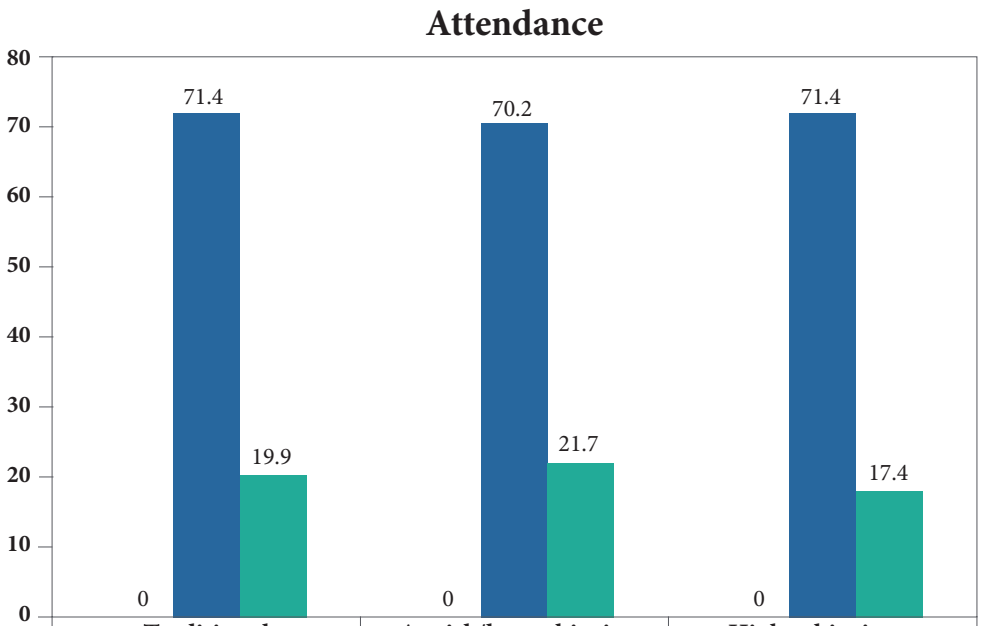
Figure T3: Teachers' beliefs on the impact of 1:1 computing on students' preparation for class



	Traditional students	At-risk/low achieving students	High achieving students
Declined	3.1	3.7	0
No Effect	51.6	59	55.3
Improved	27.3	30.4	34.2

Figure T3 illustrates teachers' beliefs on the impact of 1:1 computing on students' preparation in class. Across all types of students, the majority of teachers reported that the 1:1 technology program improved or had no effect upon the preparation of students. High achieving students were seen to benefit most from the 1:1 program with 34.2% of teachers reporting improvement in preparation compared to 27.3% for traditional students and 30.4% for at-risk/low achieving students. A small number of teachers (3.1% and 3.7% of all respondents) associated 1:1 laptops with declined student preparation for their traditional and at-risk/low achieving students.

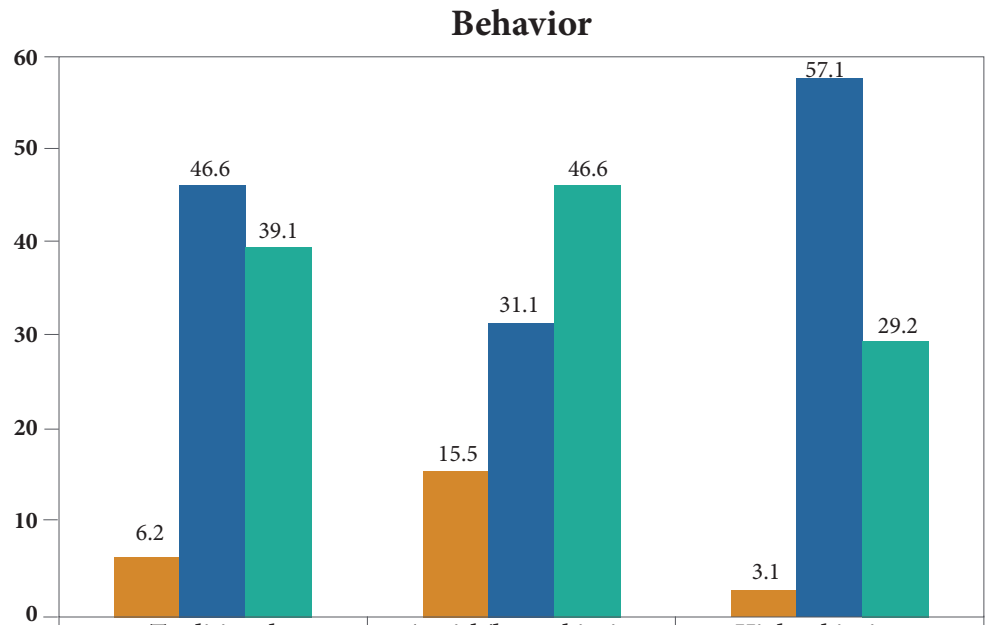
Figure T4: Teachers' beliefs on the impact of 1:1 computing on students' attendance



	Traditional students	At-risk/low achieving students	High achieving students
Declined	0	0	0
No Effect	71.4	70.2	71.4
Improved	19.9	21.7	17.4

Figure T4 illustrates teachers' beliefs on the impact of 1:1 computing on students' attendance. Across each category of students, more than 70% of teachers reported that the BWLI program had no effect upon attendance of students. The remaining respondents (approximately 20%) felt that student attendance had improved as a result of the 1:1 technology program. No teachers felt that the program had led to declines in student attendance.

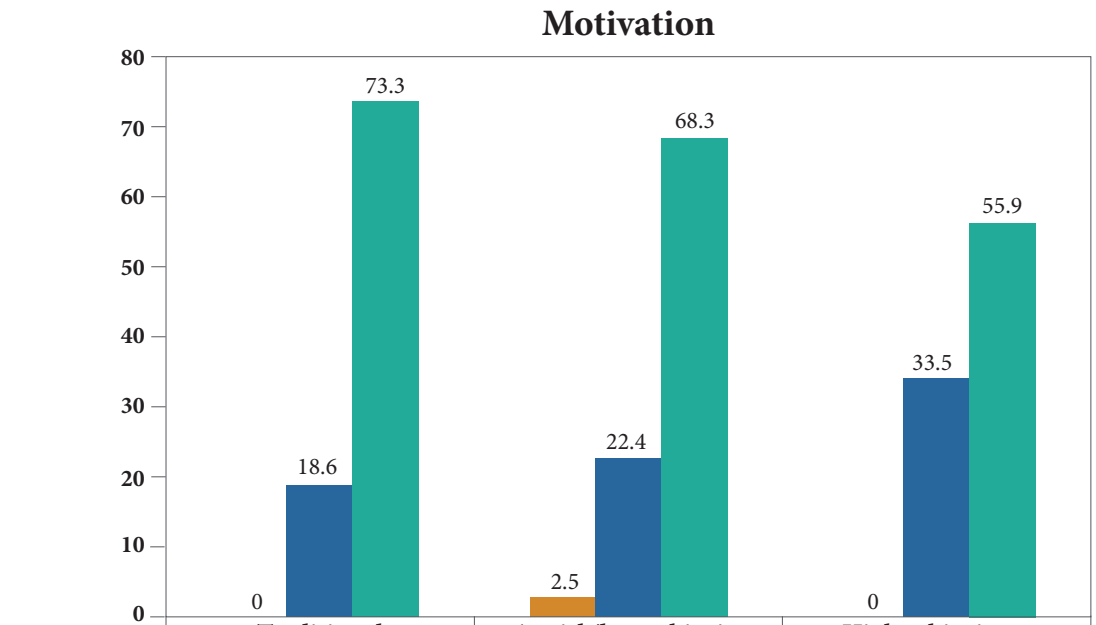
Figure T5: Teachers' beliefs on the impact of 1:1 computing on students' behavior



	Traditional students	At-risk/low achieving students	High achieving students
Declined	6.2	15.5	3.1
No Effect	46.6	31.1	57.1
Improved	39.1	46.6	28.2

Figure T5 shows teachers' beliefs on the impact of 1:1 computing on students' behavior. Across each category of students, the majority of teachers responded that students' behavior either improved or was unchanged as a result of the BWLI program. Teachers reported that their at-risk/low achieving students' behavior benefited most from the program with 46.6% of teachers observing an improvement compared to 39% and 29% for traditional and high achieving students, respectively. Approximately 15% of teachers noted that at-risk/low achieving students' behavior had declined as a result of the BWLI program.

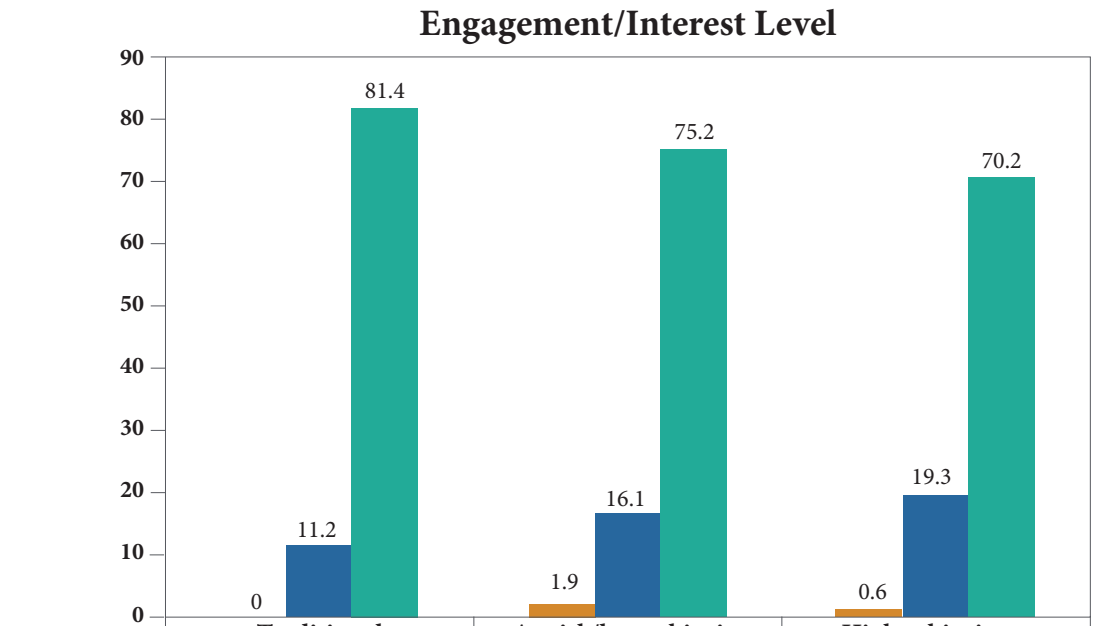
Figure T6: Teachers' beliefs on the impact of 1:1 computing on students' motivation



	Traditional students	At-risk/low achieving students	High achieving students
Declined	0	2.5	0
No Effect	18.6	22.4	33.5
Improved	73.3	68.3	55.9

Figure T6 shows teachers' beliefs on the impact of the BWLI program on students' motivation during class. For all types of students, the majority of teachers found the laptop program to improve student motivation. The largest percentage of improvement was found for traditional students with nearly 75% of 1:1 teachers reporting that student motivation improved compared to 68.3% for at-risk/low achieving students and 55.9% for high achieving students.

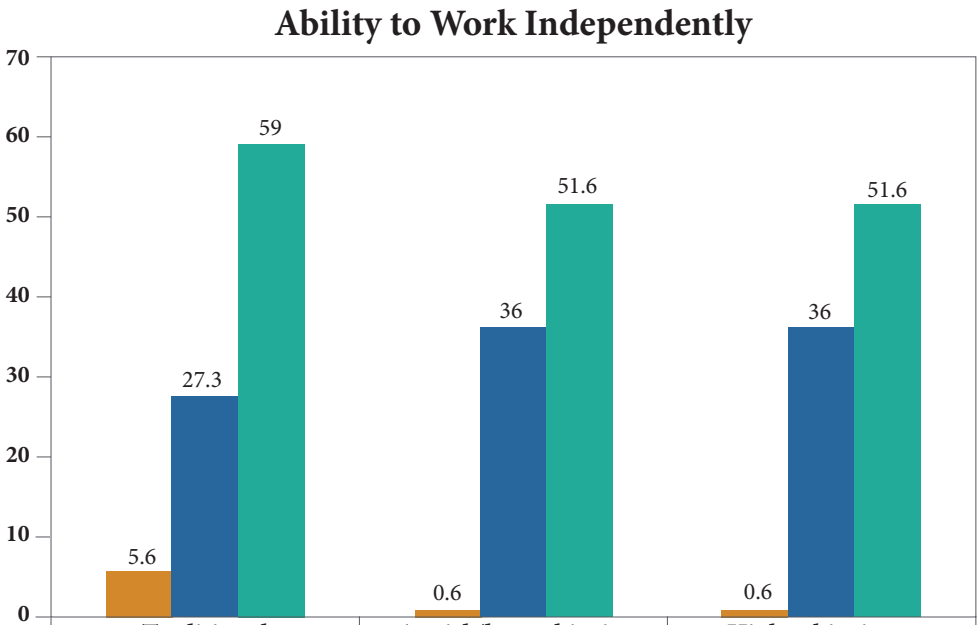
Figure T7: Teachers' beliefs on the impact of 1:1 computing on engagement/interest level



	Traditional students	At-risk/low achieving students	High achieving students
Declined	0	1.9	0.6
No Effect	11.4	16.1	19.3
Improved	81.4	75.2	70.2

Figure T7 depicts teachers' beliefs on the impact of 1:1 computing on students' engagement and interest level during class. For all types of students, teachers generally found that the BWLI program improved their students' engagement. The improved category was greatest for traditional students with over 80% of teachers reporting that student engagement improved compared to 75% for at-risk/low achieving students and 70% for high achieving students. A very small minority of teachers (1.9% of all respondents) believed that the BWLI program had led to declined student engagement for both their at-risk/low achieving students.

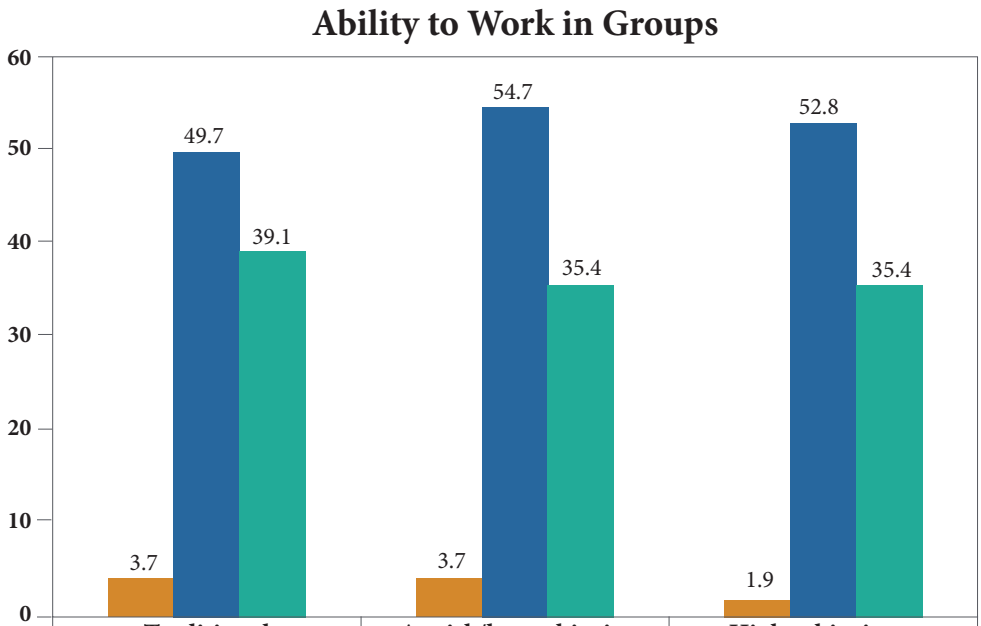
Figure T8: Teachers' beliefs on the impact of 1:1 computing on students' ability to work independently



	Traditional students	At-risk/low achieving students	High achieving students
Declined	5.6	0.6	0.6
No Effect	27.3	36	36
Improved	59	51.6	51.6

Figure T8 illustrates teachers' beliefs on the impact of 1:1 computing on students' ability to work independently. For all types of students, the majority of teachers reported that the BWLI program improved the students' independent working skills. Traditional students were seen to benefit most from the 1:1 program with 59% of teachers reporting an improvement in students' ability to work independently. Again, a small minority of teachers (5.6% of all respondents) associated 1:1 laptops with a decline in students' ability to work independently for their traditional students.

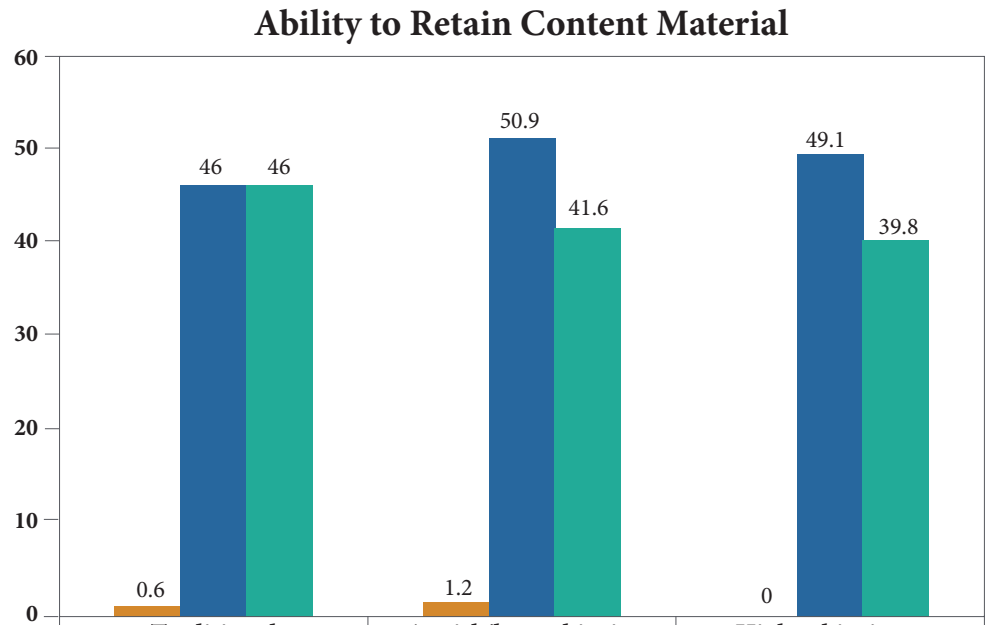
Figure T9: Teachers' beliefs on the impact of 1:1 computing on students' ability to work in groups



	Traditional students	At-risk/low achieving students	High achieving students
Declined	3.7	3.7	1.9
No Effect	49.7	54.7	52.8
Improved	39.1	35.4	35.4

Figure T9 shows teachers' beliefs on the impact of 1:1 computing on students' ability to work in groups. For all types of students, the majority of teachers generally believed that the 1:1 program improved or had no effect upon their students' independent working skills. More specifically, about half of all responding teachers reported that the BWLI program had no impact on students' ability to work in groups across all categories of students. Traditional students were seen to benefit most from the TPSE program with 39.1% of teachers reporting an improvement in students' ability to work in groups. A small number of responding teachers (3.7%) associated 1:1 laptops with a decline in students' ability to work in groups for their traditional and at risk/low achieving students.

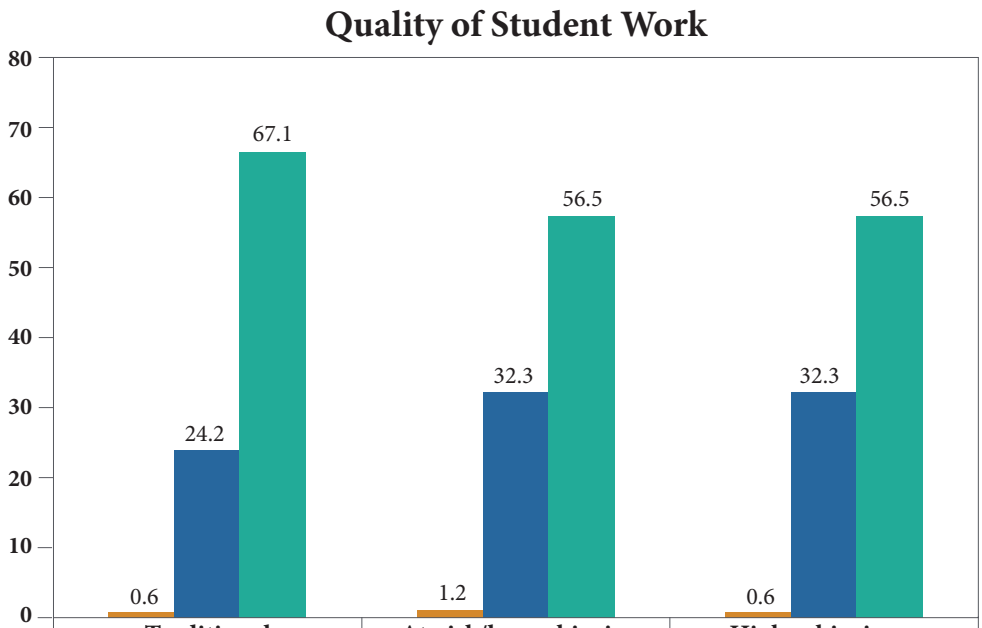
Figure T10: Teachers' beliefs on the impact of 1:1 computing on students' ability to retain content material



	Traditional students	At-risk/low achieving students	High achieving students
Declined	0.6	1.2	0
No Effect	46	50.9	49.1
Improved	46	41.6	39.8

Figure T10 shows teachers' beliefs on the impact of 1:1 computing on students' ability to retain content material. For all types of students, teachers were generally split between believing that the BWLI program improved students' ability to retain content material or had no effect. Teachers reported that at-risk/low achieving students exhibited the greatest improvement in their ability to retain content material with 46.0% of 1:1 teachers reporting improvement since the inception of the BWLI program.

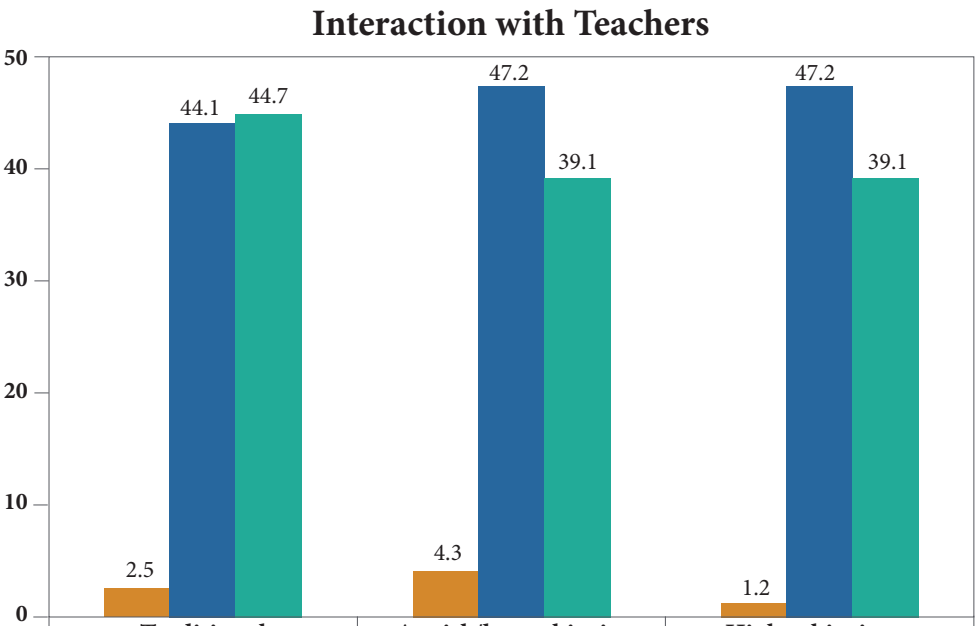
Figure T11: Teachers' beliefs on the impact of 1:1 computing on students' quality of work



	Traditional students	At-risk/low achieving students	High achieving students
Declined	0.6	1.2	0.6
No Effect	24.2	32.3	32.3
Improved	67.1	56.5	56.5

Figure T11 depicts teachers' beliefs on the impact of 1:1 computing on students' quality of work. For all types of students, the majority of teachers generally found that the BWLI program improved students' quality of work. The category with the highest percent of improvement was for traditional students with 67.1% of 1:1 teachers reporting that students' quality of work improved compared to 56.5% for both at-risk/low achieving students and high achieving students.

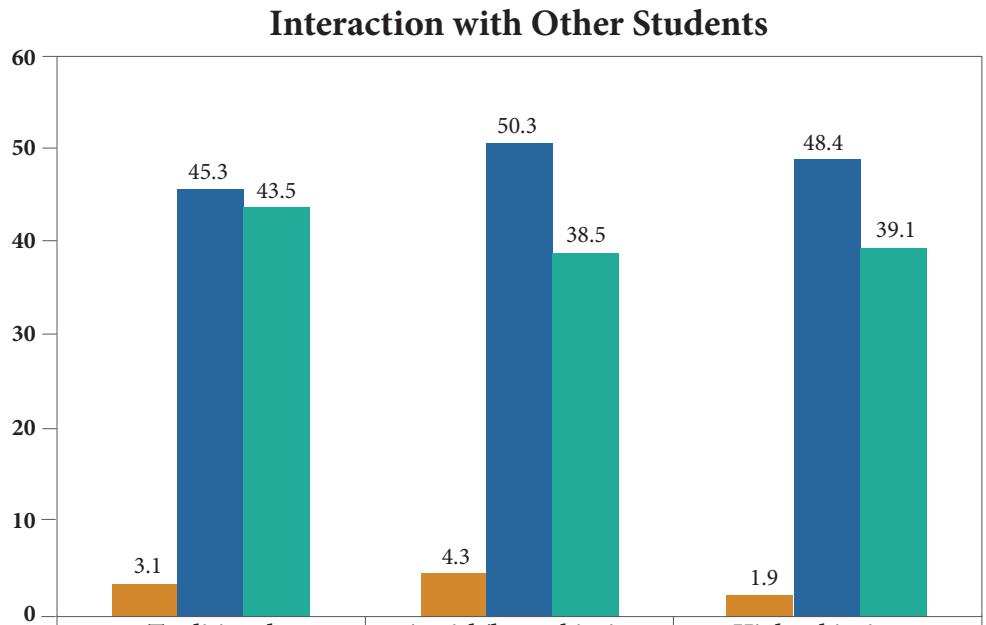
Figure T12: Teachers' beliefs on the impact of 1:1 computing on students' interactions with teachers



	Traditional students	At-risk/low achieving students	High achieving students
Declined	2.5	4.3	1.2
No Effect	44.1	47.2	47.2
Improved	44.7	39.1	39.1

Figure T12 depicts teachers' beliefs on the impact of 1:1 computing on students' interactions with teachers. For traditional students, teachers were split between believing that the BWLI program improved students' interaction with teachers (44.7%) or had no effect (44.1%). For the at-risk/low achieving students and high achieving students, teachers were slightly less positive with 47.2% of teachers stating "no effect" and 39.1% teachers noting an improvement. A small minority of teachers (4.3%) believed that the BWLI program had led to declines in the quality of students' interaction with teachers for their at-risk/low achieving students.

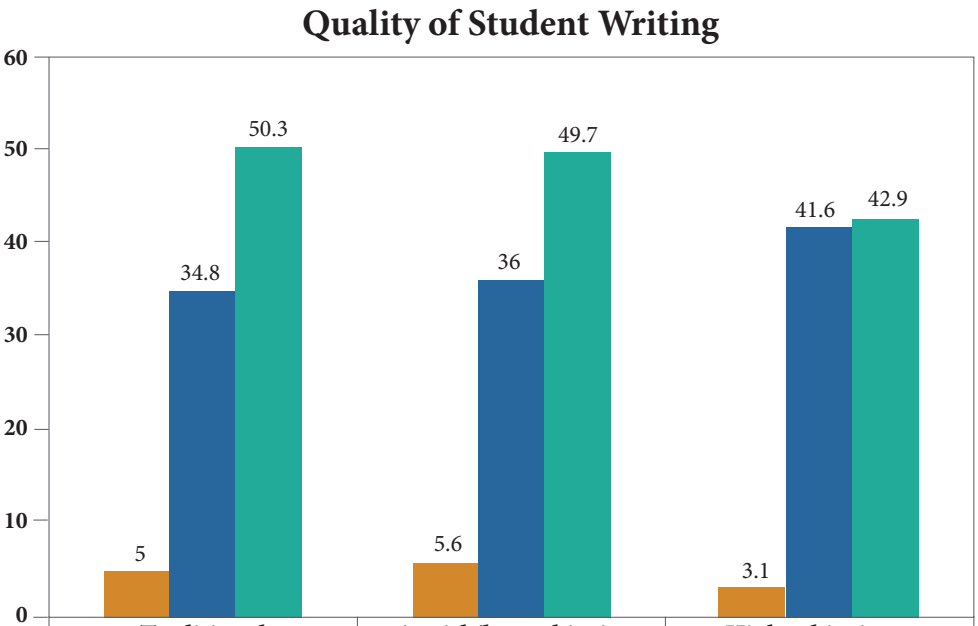
Figure T13: Teachers' beliefs on the impact of 1:1 computing on students' interaction with other students



	Traditional students	At-risk/low achieving students	High achieving students
Declined	3.1	4.3	1.9
No Effect	45.3	50.3	48.4
Improved	43.5	38.5	39.1

Figure T13 illustrates teachers' beliefs on the impact of the BWLI program on students' interactions with other students. For all types of students, teachers were generally split between believing that 1:1 computing improved students' interactions with other students or had no effect. Teachers reported that their traditional students exhibited the greatest improvement in their student to student interactions 43.5% of respondents reporting improvement since the inception of the BWLI program compared to just under 40% for the at-risk/low achieving and high achieving students.

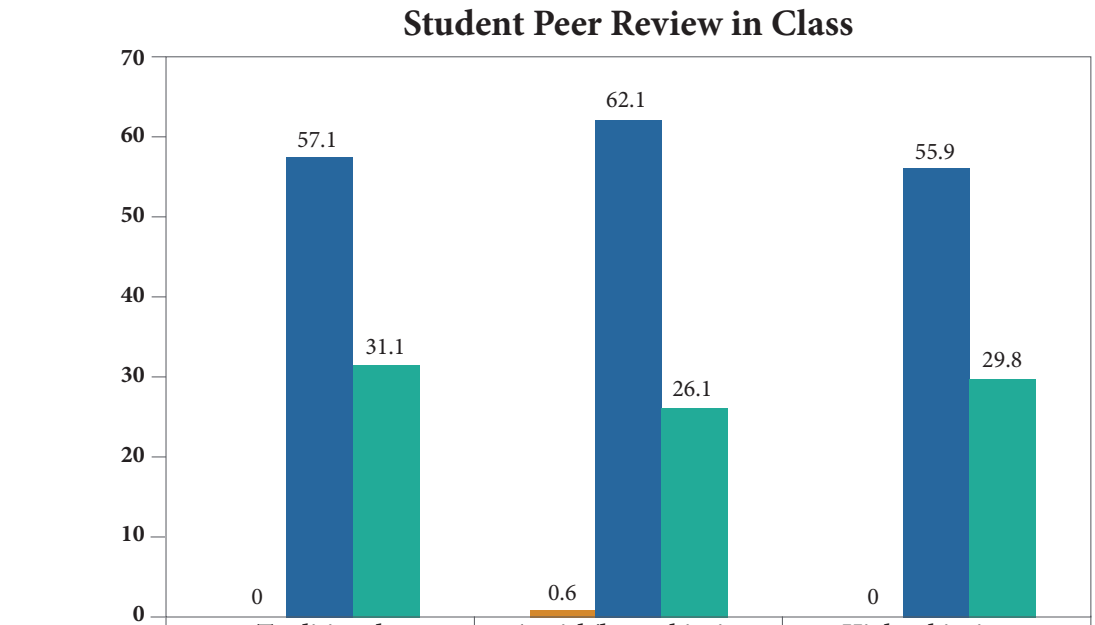
Figure T14: Teachers' beliefs on the impact of 1:1 computing on students' quality of writing



	Traditional students	At-risk/low achieving students	High achieving students
Declined	5	5.6	3.1
No Effect	34.8	36	41.6
Improved	50.3	49.7	42.9

Figure T14 illustrates teachers' beliefs on the impact of 1:1 computing on students' writing quality. For all types of students, teachers generally believed that the BWLI program improved the quality of students' writing. Traditional and at-risk/low achieving students' writing quality was seen to benefit most from the 1:1 laptops with just over 40% of teachers responding that their high-achieving students' writing quality had not been effected. Conversely, a small number of teachers (under 6% for each category) felt that their students' writing had declined as a result of the BWLI program.

Figure T15: Teachers' beliefs on the impact of 1:1 computing on students' peer review in class



	Traditional students	At-risk/low achieving students	High achieving students
Declined	0	0.6	0
No Effect	57.1	62.1	55.9
Improved	31.1	26.1	29.8

Figure T15 illustrates teachers' beliefs on the impact of 1:1 computing on students' peer review in class. Across all categories of students, the majority of teachers believed that the BWLI program had no effect upon the peer review process of students. Conversely, about one-third of all teachers felt that the peer review process of students had improved for all students with traditional (31.1%) and high achieving students (29.8%) benefiting the most.

Year 2 Student Survey Results

By mid-December 2006 every student across all grade levels had received laptops for use in school. Survey results collected in May and June 2007 from nearly all of the 1,900 BWLI students as well as over 1,100 comparison school students provide the first look at teaching and learning practices in school-wide 1:1 laptop settings.

In the next series of figures and tables, students' and teachers' use of technology is explored across BWLI schools and in comparison to the non laptop (non-1:1) students. The following tables report the frequency of technology using a 180-day scale corresponding to the 180 school days during the 2006–2007 school year. In other words, technology use is measured on a 180 point scale where zero would mean that technology was never used and 90 would mean that technology was used on every other day, on average, during the 180 days comprising the 2006–2007 academic year. The summary of students' technology use begins with Table S1, below, which illustrates the frequency of students' use of technology in the classroom during the 2006–2007 school year.

Table S1: Number of school days students reported using technology in the CLASSROOM (2006–2007 school year)

	6th Grade	7th Grade	8th Grade
Conte School	76	119	146
Herberg School	67	101	99
Reid School	81	105	105
St. Mark/St. Joe	118	134	50
North	**20**	**28**	**26**
South	**27**	**35**	**24**

Table S1 shows the average number of times students reported using technology in the classroom during the 2006–2007 school year (the second year of the BWLI implementation) across each of BWLI and comparison schools. As the table shows, the average use of technology varied across grade levels and across each school. Despite this variation across school and grade levels, some patterns of students' technology use are evident. For example, students across all grade levels reported a substantially more frequent use of technology in the BWLI classrooms than students at either comparison school where technology use generally occurred between 20 and 30 times during the year, or about once per week. Across the BWLI schools, students' technology use varied more substantially but was typically found to be at least three or four times more frequent than in the non-1:1 laptop comparison schools.

Looking more closely at only the BWLI schools, 6th grade students generally reported less frequent use compared to grades 7 and 8 where students had longer access and greater experience using school laptops. However, eighth graders at St. Joe reported using technology in their class-

rooms an average of only 50 times during the school year, the lowest average technology use reported for any of the BWLI participants. Conversely, Conte eighth graders reported the most frequent use of technology in the classroom with an average of 146 times during the school year. Across the BWLI 6th and 7th grades, St. Mark students reported the most widespread use of technology in its classrooms (118 and 134 times during the school year, respectively).

In addition to technology use in the classroom, technology use in non-classroom school settings was also examined in the student survey for the 2006–2007 school year. Table S2 shows the average number of times students from BWLI and comparison schools reported using technology in a computer lab during the 2006–2007 school year.

Table S2: Number of school days students reported using technology in a COMPUTER LAB (2006–2007 school year)

	6th Grade	7th Grade	8th Grade
Conte School	10	37	1
Herberg School	38	38	24
Reid School	73	65	40
St. Mark/St. Joe	62	57	5
North	**39**	**17**	**17**
South	**21**	**32**	**17**

Table S2 displays the average number of times students reported using technology in computer labs during the 2006–2007 school year across both BWLI and comparison schools. Students in BWLI schools generally reported less frequent use of technology in computer labs compared to the frequency of use in the BWLI classrooms (reported above in Table S1). In other words, students in BWLI settings typically use technology more frequently in the classroom than in school computer labs. However, students reported wide variation in the frequency of their technology use in computer labs across each of the BWLI schools and each grade level. For example, Conte 8th graders reported the least frequent use of technology in a computer lab with an average use of only one day per year while Herberg 6th grade students reported the most frequent use with an average of 73 times per school year, or nearly every other day.

In general, 8th grade students used technology in computer labs less frequently than students in the lower grades at the 1:1 schools. Interestingly, this pattern is the opposite of the pattern reported in Table S1 where technology use in the classroom occurred more frequently in the upper grade levels. In addition, students also reported the frequency of their technology use in the school library as summarized on the next page in Table S3 for both the BWLI and comparison schools.

Table S3: Number of school days students reported using technology in the LIBRARY (2006–2007 school year)

	6th Grade	7th Grade	8th Grade
Conte School	4	9	5
Herberg School	20	12	11
Reid School	10	6	7
St. Mark/St. Joe	50	40	1
North	**21**	**8**	**9**
South	**11**	**10**	**6**

Table S3 shows the average number of times students reported using technology in the school library during the 2006–2007 school year across both BWLI and comparison schools. Overall, BWLI students generally reported less frequent use of technology in the school library compared to classroom and computer lab use. However, St. Mark's 6th and 7th grade students reported using technology in the library an average of 50 and 40 respective occasions during the 2006–2007 school year, or about once every 4 days.

Looking cumulatively across Tables S1, S2, and S3 we can see that the majority of BWLI students used technology for at least some portion of every day during the 2006–2007 school year. Although some use was reported to occur in the school library and in computer labs, the majority of BWLI students' technology use occurred in the classroom. However, the preceding tables also show that there was substantial variation in technology use across grade levels at many schools. Summarizing Year 2 student results across grade levels allows for a more succinct examination student technology use, however, the fact that such summaries fail to demonstrate the variation reported across grade levels should be remembered. Figure S1 shows the average number of days students reported using technology during the 2006–2007 school year across for each of the BWLI and comparison schools.

Figure S1: Average number of school days students reported using technology (2006–2007 school year)

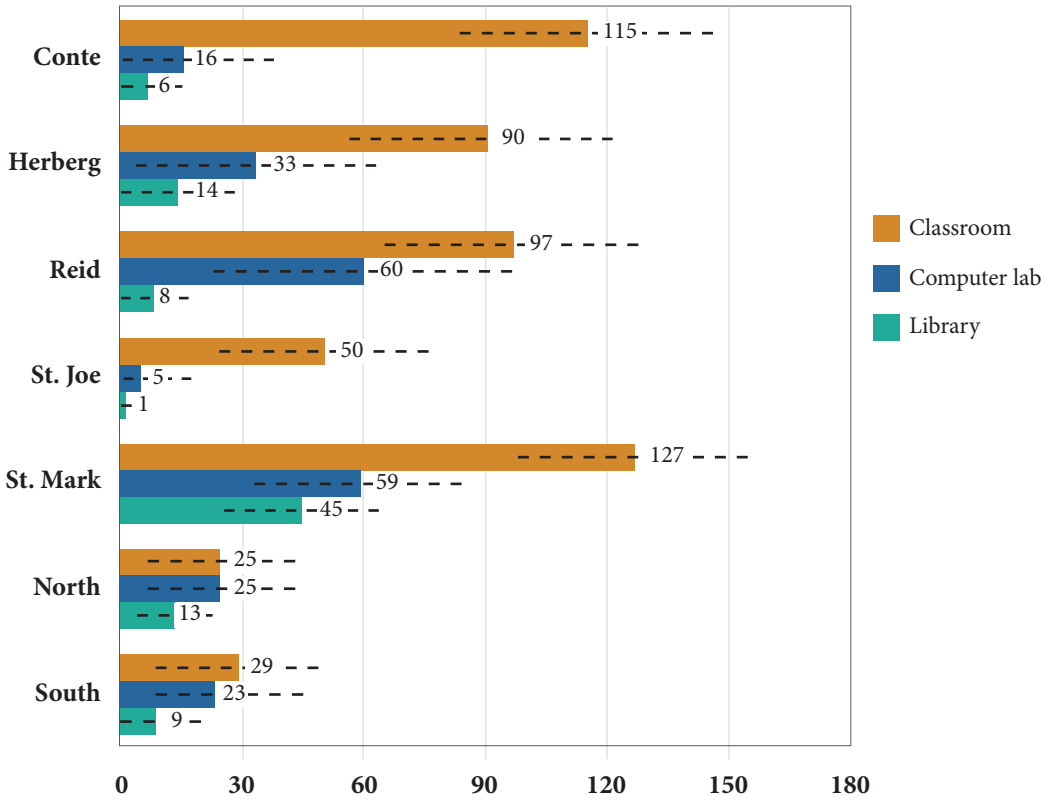


Figure S1 shows the average number of days students reported using technology in their classrooms, in school computer labs, and in the school library during the 180 potential days of the 2006-2007 school year. In the figure, students' use of technology in the classroom is displayed by blue horizontal bars while computer use in the computer lab and library are represented by red and yellow bars, respectively. In addition, error bars provide a visual indicator of the variability of the calculated averages with dashed lines representing a full standard deviation. Looking across the BWLI schools during the 2006/2007 school year, St. Mark students reported the most frequent average use of computers in school while St. Joe 8th graders reported the least.

An analysis of variance between the BWLI students' and comparison school students' Year 2 survey results showed that the greater frequency of BWLI student technology use was statistically significant "in the classroom" (F=1074.5; Sig. 0001) and "in the computer lab" (F= 53.152; Sig. 0001) but not "in the library" (F=.355; Sig. 552) compared to the non-BWLI students. In other words, the frequency of technology use in classrooms and in computer labs was so much greater in the BWLI settings than comparison settings that the difference could not be reasonably expected from chance. However, the difference between the average frequency of students' computer use in the library was not statistically significant between the BWLI and comparison students.

The next series of Tables (S4–S11) further explores students' use of technology in four primary subject areas across the BWLI and comparison schools during the 2006–2007 school year.

Table S4: Number of school days STUDENTS reported using a computer in READING/ELA class (2006–2007 school year)

	6th Grade	7th Grade	8th Grade
Conte School	29	86	95
Herberg School	37	50	60
Reid School	64	55	68
St. Mark/St. Joe	62	67	12
North	**13**	**17**	**14**
South	**15**	**36**	**18**

Table S4 shows the average number of times students reported using technology in their Reading/English Language Arts classes during the 2006–2007 school year for both BWLI and comparison schools. Despite a great deal of variation across the BWLI schools and across grade levels, BWLI students generally reported using computers in their ELA/Reading classes with much greater frequency than students in the two comparison schools during the 2006–2007 school year. As the table shows, each BWLI school exhibited different patterns of computer use across each of the different grade levels. For example, 6th grade Conte students reported the least frequent use of computers in Reading/ELA class compared to the other BWLI 6th grades, (29 times per year, or about once every 6 days) but exhibited the most frequent Reading/ELA use of any 8th grade class (95 times per year). Students in 6th and 7th grade at St. Mark reported using computers over 60 times per year in their Reading/ELA classes, but 8th graders at St. Joe reported the least frequent use of any grade level using their computers an average of only 12 times during the school year. Relatively less variation across grade levels was reported for Reid, Herberg, and the comparison schools.

In addition to reporting how frequently they themselves used technology during the 2006–2007 school year across each of their primary subject areas, students also estimated the frequency that their teachers used technology in their classes during this same time period. For example, Table S5, next page, displays the average number of school days students reported that their teachers used a computer in their Reading/English Language Arts classes during the 2006–2007 school year.

Table S5: Number of school days students reported their TEACHER using a computer in READING/ELA class (2006–2007 school year)

	6th Grade	7th Grade	8th Grade
Conte School	48	92	119
Herberg School	79	77	74
Reid School	93	119	113
St. Mark/St. Joe	100	84	3
North	**91**	**106**	**90**
South	**64**	**114**	**118**

Like the Reading/ELA student use presented previously in Table S4, Table S5 shows that teachers' use of technology in Reading/ELA varied considerably across the BWLI schools as well as across different grade levels within the schools. In general, the relationship between students' and teachers' use of technology within Reading/ELA classes was positive, indicating that classrooms where teachers regularly used technology were often classes where students used technology. However, the large differences observed for student use between the BWLI and comparison schools was not observed for teachers' computer use in Reading/ELA classes where comparison school teachers made widespread use of technology in their teaching, often more frequently then the BWLI teachers.

As the table above shows, most BWLI schools again exhibited different patterns of computer use across each of the different grade levels. For example, Conte 6th grade teachers were reported to use computers in Reading/ELA class less frequently than the other BWLI 6th grade teachers, (48 times per year) but exhibited the most frequent Reading/ELA use of any 8th grade class (119 times per year). Again, similar to the student use, teachers in 6th and 7th grade at St. Mark were reported to regularly use computers in their Reading/ELA classes, but 8th grade students at St. Joe reported their Reading/ELA teachers only rarely used a computer with the class during the 2006–2007 school year. Looking at the Pittsfield public schools, relatively little variation was reported at Herberg and Reid across grade levels. Table S6 continues the exploration of students' use of technology during the second year of the BWLI implementation, showing the average number of school days students reported using a computer in Math class (2006–2007 school year).

Table S6: Number of school days STUDENTS reported using a computer in MATH class (2006–2007 school year)

	6th Grade	7th Grade	8th Grade
Conte School	48	87	15
Herberg School	32	59	38
Reid School	43	76	29
St. Mark/St. Joe	33	7	1
North	**5**	**3**	**7**
South	**11**	**15**	**12**

Like the Reading/ELA results, a great deal of variation across the BWLI schools as well as across grade levels was observed. Despite this variation, BWLI students typically reported using computers in their Math classes with much greater frequency than students in the two comparison schools over the course of the 2006–2007 school year. As the table shows, each BWLI school exhibited different patterns of computer use across each of the different grade levels. For example, Conte students reported the most frequent use of computers in Math class compared to the other BWLI 7th grades (87 times per year, or about every other day), but exhibited substantially less use in the 8th grade class (15 times per year). St. Joe 8th graders reported using their computers very little in their Math classes with an average of only one day of use in the 2006–2007 school year, whereas students in the comparison generally reported using computers in math between 5 and 12 times during this same period. Table S7, below, displays the average number of school days students reported that their teachers used a computer in their Math classes during the 2006–2007 school year.

Table S7: Number of school days students reported their TEACHER using a computer in MATH class (2006–2007 school year)

	6th Grade	7th Grade	8th Grade
Conte School	67	95	91
Herberg School	70	96	80
Reid School	95	123	89
St. Mark/St. Joe	75	45	3
North	**82**	**95**	**83**
South	**60**	**95**	**98**

Like the other patterns of Year 2 student and teacher computer use, Table 11 shows that teachers' use of technology in Math classes varied across the BWLI schools as well as across different

grade levels within the schools. Like the Reading/ELA results, the relationship between students' and teachers' use of technology within Math classes was found to be positive, indicating that classrooms where teachers regularly used technology were often classes where students used technology. However, the large differences observed between the BWLI and comparison student use of computers was not shared for teachers' computer use in Math classes where the comparison school teachers actually made widespread use of technology in their teaching, often more frequently then the BWLI teachers.

As Table S7 displays, many of the BWLI schools again exhibited different patterns of computer use across each of the different grade levels. For example, Conte 6th grade teachers were reported to use computers in Math class less than the other BWLI 6th grades, (67 times per year) but exhibited the most frequent Math use of any 8th grade BWLI class (91 times per year). Again, similar to the student use, teachers in 6th and 7th grade at St. Mark were reported to regularly use computers in their Math classes, but 8th grade students at St. Joe reported their Math teachers rarely used their computers with the class during the 2006–2007 school year. Reid 7th graders reported that their Math teachers made the most frequent use of technology in their math classes, using computers an average of 123 times during the 2006–2007 year. Like the Reading/ELA results, relatively little variation across grade levels was reported by Herberg students who reported their Math teachers used computers in class approximately every other day across all grade levels.

Table S8 continues the exploration of students' use of technology during the second year of the BWLI implementation, showing the average number of school days students reported using a computer in Social Studies class (2006–2007 school year).

Table S8: Number of school days STUDENTS reported using a computer in SOCIAL STUDIES class (2006–2007 school year)

	6th Grade	7th Grade	8th Grade
Conte School	14	36	60
Herberg School	24	50	38
Reid School	37	82	59
St. Mark/St. Joe	23	109	36
North	**12**	**10**	**10**
South	**9**	**14**	**5**

Like the results for the other subject areas, there was again substantial variation in the frequency of Social Studies computer use across the BWLI schools and across grade levels within each 1:1 school. Despite this variation, BWLI students typically reported using computers in their Social Studies classes with much greater frequency than students in the two comparison schools over the course of the 2006–2007 school year. As Table S8 shows, each BWLI school exhibited somewhat different patterns of computer use across different grade levels. For example, the Conte results show

a gradually increasing use of computers in Social Studies as students reach the upper grade levels. A different pattern emerged at the Pittsfield public schools (Herberg and Reid) where students reported the most frequent use of computers in Social Studies class occurred in the 7th grade classes. Similarly, St. Mark 7th grade students reported the most frequent use of computers in Social Studies of students across all of the schools, with an average of 109 times during the 2006–2007 school year, while students at the comparison schools reported using computers in Social Studies between 5 and 14 times during the year, on average. Table S9, below, displays the average number of school days students reported that their teachers used a computer in their Social Studies classes during the 2006–2007 school year.

Table S9: Number of school days students reported their TEACHER using a computer in SOCIAL STUDIES class (2006–2007 school year)

	6th Grade	7th Grade	8th Grade
Conte School	26	34	102
Herberg School	68	92	69
Reid School	82	114	92
St. Mark/St. Joe	89	132	106
North	**78**	**106**	**104**
South	**64**	**101**	**91**

For most grade levels and schools, the results show that teachers used computers more frequently than their students in Social Studies (Table S9), which was especially true in the two comparison schools. However, like the results in other subject areas, the relationship between students' and teachers' use of technology within Social Studies classes was positive, indicating again that classrooms where teachers regularly used technology were often classes where students used technology. As such, many of the patterns observed for students' use of computers in Social Studies classes (Table S8) were similar across the different grade levels at BWLI schools.

Like the other results of Year 2 student and teacher computer use, Table S9 shows that teachers' use of technology in Social Studies classes varied across the BWLI schools as well as across different grade levels within the schools. However, the large differences observed for student use between the BWLI and comparison schools was not shared for teachers' computer use in Social Studies classes where comparison school teachers made widespread use of technology in their teaching, often more frequently then the BWLI teachers. For example, the Conte teachers were reported to have increased their use of computers in Social Studies through the grades. At the Pittsfield public schools (Herberg and Reid), teachers were reported to use computers more frequently in the 7th grade Social Studies classes than in 6th or 8th grade.

Table S10 completes the exploration of students' use of technology during the second year of the BWLI implementation (2006–2007 school year) across primary subject areas showing the average number of school days students used a computer in Science class.

Table S10: Number of school days STUDENTS reported using a computer in SCIENCE class (2006–2007 school year)

	6th Grade	7th Grade	8th Grade
Conte School	26	66	87
Herberg School	24	78	54
Reid School	21	55	87
St. Mark/St. Joe	29	41	20
North	**13**	**10**	**7**
South	**10**	**18**	**5**

Like the results for the other subject areas, there was a great deal of variation in the frequency of Science computer use across the BWLI schools and across grade levels within each 1:1 school. Despite this variation, BWLI students typically reported using computers in their Science classes much more frequently than students in the two comparison schools during the course of the 2006–2007 school year. As Table S10 shows, each BWLI school exhibited somewhat different patterns of computer use across different grade levels. For example, the Conte students again reported gradual increases in the use of computers for the upper grades. A nearly identical pattern emerged at Reid. St. Mark and Herberg students both reported that the most frequent use of computers in Science class occurred in the 7th grade classes. Students at the two comparison schools generally reported infrequent use of computers in Science (between 5 and 18 times during the year, on average).

Table S11, below, shows the average number of school days students reported that their teachers used a computer in their Science classes during the 2006–2007 school year.

Table S11: Number of school days students reported their TEACHER using a computer in SCIENCE class (2006–2007 school year)

	6th Grade	7th Grade	8th Grade
Conte School	48	87	15
Herberg School	32	59	38
Reid School	43	76	29
St. Mark/St. Joe	33	7	1
North	**5**	**3**	**7**
South	**11**	**15**	**12**

For nearly all grade levels and schools, Table S11 displays that BWLI teachers used computers substantially more often then Science teachers in the two comparison schools. However, like the results across the other subject areas, Table S11 shows that teachers' use of technology in Science classes varied across the BWLI schools as well as across the different grade levels within each schools. For example, 7th grade Science teachers from Conte, Herberg, and Reid schools were observed to use technology more frequently than teachers in other grades. At St. Mark, teachers were reported to use computers more frequently in 6th grade Science classes then in grades 7 or 8 where computer use was similar to (or less than) comparison school averages where teachers used computers about once per month.

Tables S4 through S11 explore the average frequency of computer use across the core curriculum for BWLI and comparison school students and teachers during the second year of the BWLI implementation. Across nearly all BWLI schools, there was variation reported across grade levels in how frequently students and teachers within a school used their BWLI laptops. Such patterns and variation in computer use illustrates the complicated nature of summarizing and presenting complex technology use data.

Figure S2: Average number of school days STUDENTS reported using technology by primary subject area (2006–2007 school year)

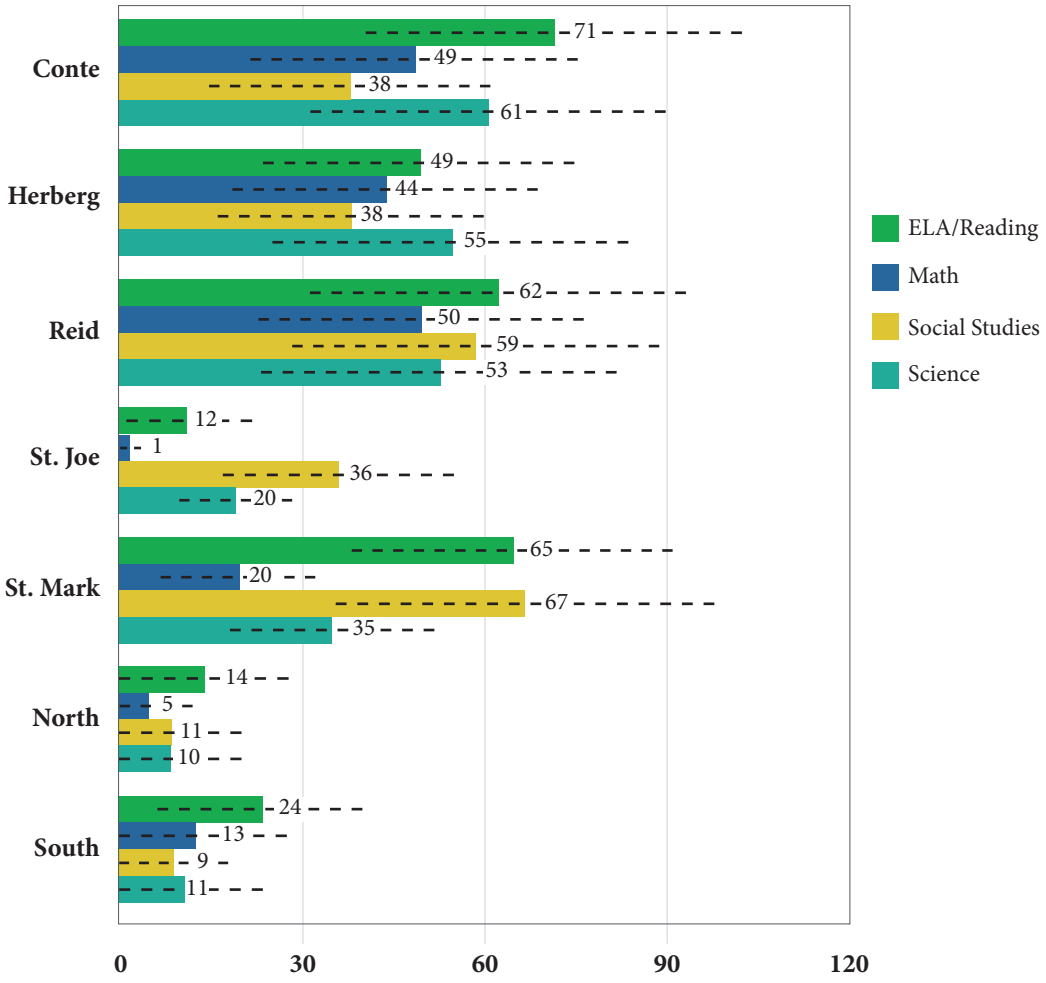


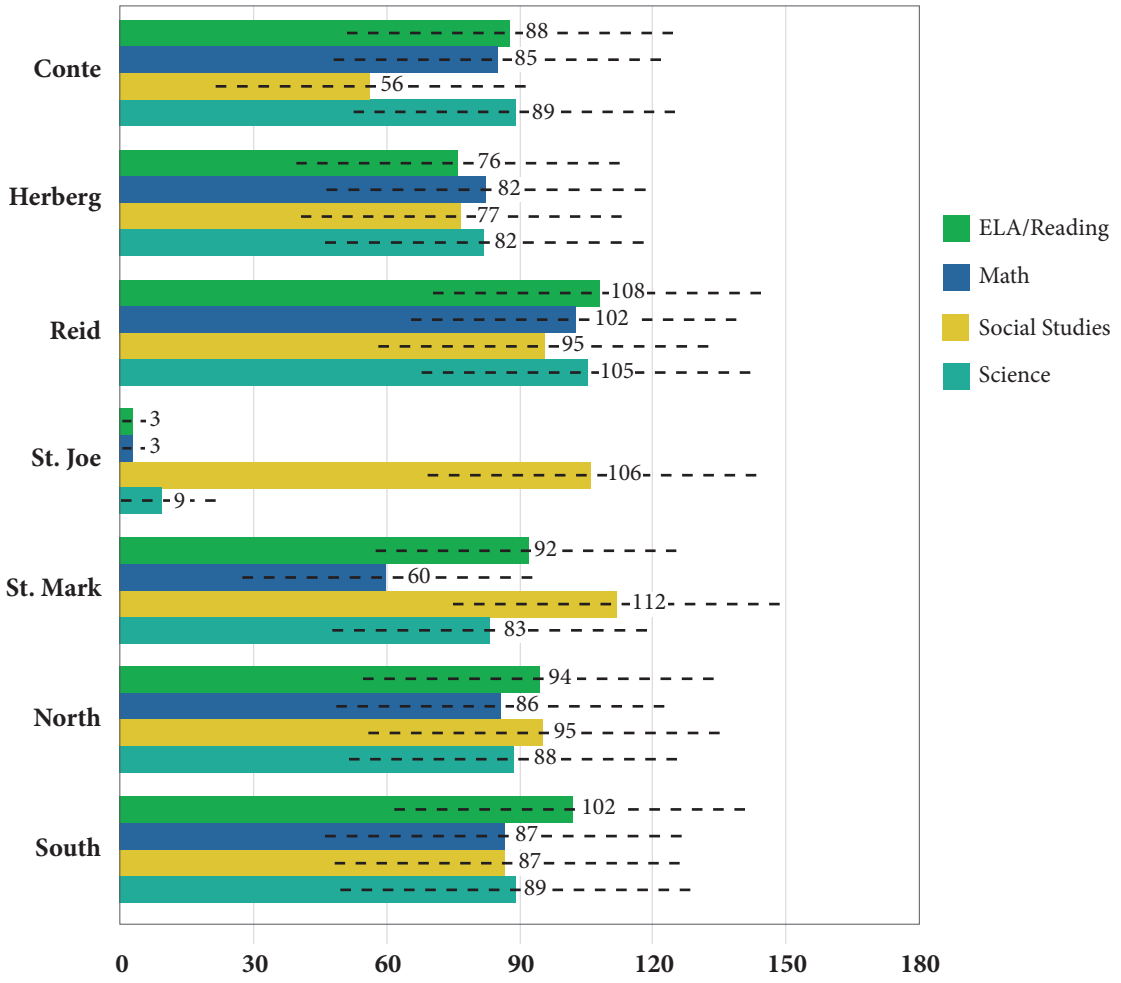
Figure S2 displays the average number of days students reported using computers across four primary subject areas during the potential 180 school days of the 2006–2007 school year. In the above figure, students' frequency of computer use is represented by four horizontal bars corresponding to the four surveyed subject areas. As summarized in the figure's legend, computer use in Reading/ELA is displayed in purple, Math in yellow, Social Studies in red, and Science in light blue. In addition, error bars provide a visual indicator of the variability of the calculated school averages with dashed lines representing one full standard deviation. A number of interesting and noteworthy features are prominent in Figure S2. First, there is substantial variability in the frequency of use across subject areas within most of the BWLI schools. For example, students across all grade levels at St. Mark reported using their computers nearly 70 times in their Reading/ELA and Social Studies classes during the 2006–2007 school year while only 20 times in their Math classes. Looking across the schools for subject area trends, we find that in three of the five BWLI schools, Math classes were

the site of the least amount of technology use, while Social Studies was the site of the least frequent use in the other two BWLI schools. Similarly, no single subject area received universal high use at more than two schools, suggesting that factors within each school play a larger role in the adoption and student use of technology than factors related to individual subject areas.

Looking cumulatively across the BWLI school averages during the 2006–2007 school year, St. Joe students reported the least frequent use with the average St. Joe student reporting a total of 69 instances of computer use across these primary subject areas during the 2006–2007 school year. Students at the Reid school reported the most frequent cumulative use with the average student reporting that they had used a computer across these four classes on 224 occasions during the school year. Close behind, the average Conte students reported 219 cumulative uses of a computer in these subjects across this same period while St. Mark and Herberg students reported 187 and 186 respective instances of computer use. What this means is that, on average, BWLI students used their laptop computers on a greater-than-daily basis during the 2006–2007 school year.

When compared to the students in the two matched comparison schools, BWLI students typically reported using technology three to four times more frequently during the 2006–2007 school year, although it is important to consider the variation across and within the 1:1 schools. The difference between the BWLI students and comparison school students' Year 2 survey results were tested for statistical significance using an analysis of variance. The results of the analysis of variance showed that the difference between the BWLI and comparison students use of technology was statistically significant ($p < .0001$) across all surveyed subject areas. In addition to the examination of cumulative student technology use across primary subject areas during the 2006–2007 school year, students also reported their teachers' frequency of technology use in the classroom. Figure S3 shows the average number of school days teachers used technology with their classes as reported by their students during the 2006–2007 school year.

Figure S3: Average number of school days TEACHERS used technology with their classes as reported by their students (2006–2007 school year)



In the above figure, teachers' reported frequency of computer use is represented by four vertical bars corresponding to the four surveyed subject areas. As summarized in the figure's legend, computer use in Reading/ELA is displayed in purple, Math in yellow, Social Studies in red, and Science in light blue. In addition, error bars provide a visual indicator of the variability of the calculated school averages with dashed lines representing one full standard deviation. Looking cumulatively across the subject areas, we can see that teachers used computers less in Math than other classes and most frequently in Social Studies and Reading/ELA, similar to the student use results reported above. However, teachers' reported use of technology fluctuated less than students' use of technology across subject areas and across schools. In other words, compared to the student use results in Figure S2, there is less variability in teachers' frequency of technology use across subject areas than was observed for students' use. In addition, teachers typically used computers substantially more

frequently than their students did during the 2006–2007 school year. This increased use for teachers was a particularly prominent result in both of the comparison schools where teachers' frequency of technology often averaged higher than many BWLI schools. In fact, when summing the results across all subject areas, only Reid teachers averaged more frequent technology use than the teachers in the two matched comparison schools where students reported an average of 364 instances where their primary subject teachers used a computer during the 2006–2007 school year. St. Joe students reported the least frequent cumulative use for their teachers with only 121 instances of use while Conte and Herberg averages near 318 instances.

Although the difference between the BWLI school and comparison school tallies show that, on average, many BWLI teachers cumulatively used technology less than their comparison school colleagues, individual student data compared from BWLI and comparison school results for each subject area provides a more precise picture.

For each of the surveyed primary subject areas, analysis of variance testing was performed on the frequency of teachers' computer use as reported by BWLI and comparison school students during the 2006–2007 school year. In Social Studies and Reading/ELA classes, the results showed that BWLI teachers had used computers statistically more frequently than the comparison group teachers ($F=12.1$; $p=.001$ and $F=10.2$; $p=.001$, respectively). However, the differences between the BWLI and comparison school Math and Science teachers did not yield statistically significant results. In other words, the difference between 1:1 and non-1:1 teachers' computer use was no greater than chance for Math and Science teachers during the 2006–2007 school year. Interestingly, the similarity between math and science teachers' frequency of computer use in the classroom is more attributable to the widespread and frequent use of computers by teachers in the two comparison schools, rather than unexpectedly low results in BWLI schools.

In the following tables, student technology use is examined in greater detail. Given the fluctuations in computer use across grade levels, student results are presented separately across grade levels and schools in Tables S12 through S15. Table S12, next page, examines 6th grade BWLI and comparison school students' technology use in school during the 2006–20007 school year for a wide variety of different educational technology applications.

Table S12: Number of times during the 2006–2007 school year that 6th grade students reported using a variety of specific technology applications in school

	Conte	Herberg	Reid	St. Mark	North	South
In the last year how often did you use a computer in school to:						
Send and receive email	0	9	14	2	5	9
Write first drafts	10	24	23	33	14	13
Edit papers using a computer	10	27	32	33	13	16
Create graphs or tables	12	9	18	19	4	7
Find information on the Internet	76	81	85	119	44	29
Create a Hyperstudio/PowerPoint presentation	22	18	27	26	10	3
Play computer games	48	27	53	50	20	20
Work with spreadsheets/databases	7	6	12	18	2	4
Solve problems	20	24	25	31	8	12
Analyze data	12	12	17	22	7	5
Take a test, quiz, or practice test	22	23	37	17	9	12
Take notes in class using a computer	22	16	21	30	4	6
Present information to the class	12	15	20	18	9	5
Keep track of dates and schedule/ calendar	11	19	10	24	2	2
Access a teacher's web site	55	40	41	60	8	9
Email a teacher	2	2	3	0	2	1
Help a teacher fix a computer problem	7	9	6	10	5	5
Help a student fix a computer problem	14	17	20	41	9	8

Table S12 displays the number of times during the 2006–2007 school year that 6th grade students reported using a variety of specific technology uses in school. Across the 6th grade classes, it is evident from Table S12 that students across the BWLI schools typically used technology for a wide variety of activities and with greater frequency than students at the comparison schools. An analysis of the variance between the BWLI and comparison school 6th grade students determined that the more frequent technology use exhibited by BWLI students represented a statistically significant difference ($p<.001$) for all uses in Table S12 except using a computer to "send and receive email", "take a test, quiz, or practice test", and "help teacher fix a computer problem". In other words, there was a substantially more frequent technology use in the BWLI 6th grade classes than in the comparison schools for nearly all measured technology uses.

Across the BWLI 6th grade classes, students generally reported that using a computer to "find information on the Internet", "access a teacher's website", and "play computer games" were among the most frequently occurring uses. It should be noted that the typically negative association with computer games may not be warranted, given that the majority of the "games" played by the BWLI students on their computers were educationally based. However, there were substantial differences across patterns of sixth grade computer use at BWLI schools. For example, sixth grade students at St. Mark averaged 41 instances of "helping a student fix a computer problem" while this occurred 20 or less times in the other schools. Below, this same survey data is explored for 7th grade students at BWLI and comparison schools.

Table S13: Number of times during the 2006–2007 school year that 7th grade students reported using a variety of specific technology applications in school

	Conte	Herberg	Reid	St. Mark	North	South
In the last year how often did you use a computer in school to:						
Send and receive email	3	8	24	13	3	5
Write first drafts	31	26	29	26	10	18
Edit papers using a computer	24	33	34	43	12	25
Create graphs or tables	19	13	24	9	7	6
Find information on the Internet	108	107	98	120	39	50
Create a Hyperstudio/PowerPoint presentation	42	28	25	32	5	7
Play computer games	55	15	47	45	14	41
Work with spreadsheets/databases	19	8	18	5	7	5
Solve problems	36	34	42	20	8	18
Analyze data	16	15	26	15	4	9
Take a test, quiz, or practice test	24	29	40	29	3	27
Take notes in class using a computer	43	38	47	39	6	6
Present information to the class	27	23	21	20	4	7
Keep track of dates and schedule/ calendar	15	19	14	11	0	3
Access a teacher's web site	94	74	68	51	2	4
Email a teacher	2	11	25	0	0	2
Help a teacher fix a computer problem	8	7	4	2	2	4
Help a student fix a computer problem	18	14	11	22	5	13

Table S13 shows the number of times during the 2006–2007 school year that 7th grade students reported using a variety of specific technology uses in school. Across the seventh grade classes, it is clear from Table S13 that students in the BWLI schools typically used technology for a wide variety of activities and with greater frequency than students at the comparison schools. An analysis of the variance between the BWLI and comparison school 7th grade students' determined that the more frequent technology use exhibited by BWLI students represented a statistically significant difference ($p<.001$) for all of the uses listed in Table S13 except using a computer to "help a student fix a computer problem", and "help teacher fix a computer problem". In other words, like the sixth grade results, there was a substantially more computer use in the BWLI 7th grade classes than in the respective comparison classrooms across nearly all measured technology uses.

Across the BWLI 7th grade classes, students generally reported that using a computer to "find information on the Internet", "access a teacher's website", and "take notes in class using a computer" were among the most frequently occurring uses. However, there were substantial differences across patterns of seventh grade computer use at BWLI schools. For example, Conte seventh graders reported accessing a teacher's web site on 94 days during the school year while this occurred 51 times at St. Mark. The frequency of "playing computer games" was also reported by students to widely vary across the BWLI schools. Below, this same survey data is explored for 8th grade students at BWLI and comparison schools.

Table S14: Number of times during the 2006–2007 school year that 8th grade students reported using a variety of specific technology applications in school

	Conte	Herberg	Reid	St. Joe	North	South
In the last year how often did you use a computer in school to:						
Send and receive email	11	33	29	7	6	6
Write first drafts	27	36	38	9	7	10
Edit papers using a computer	28	43	41	14	14	12
Create graphs or tables	26	11	19	6	6	3
Find information on the Internet	107	91	92	56	43	40
Create a Hyperstudio/PowerPoint presentation	48	20	19	17	12	9
Play computer games	36	9	20	10	19	20
Work with spreadsheets/databases	20	9	12	5	4	4
Solve problems	29	26	24	8	6	8
Analyze data	26	16	18	6	6	5
Take a test, quiz, or practice test	40	28	21	6	5	9
Take notes in class using a computer	29	42	56	27	3	4
Present information to the class	34	17	12	12	9	9
Keep track of dates and schedule/ calendar	15	12	18	6	4	2
Access a teacher's web site	104	71	54	6	2	5
Email a teacher	7	15	15	2	0	2
Help a teacher fix a computer problem	9	7	7	6	6	2
Help a student fix a computer problem	12	12	13	11	4	6

Table S14 displays the number of times during the 2006–2007 school year that 8th grade students reported using a variety of specific technology uses in school. Table S14 shows that students across the BWLI schools used technology for a wide variety of activities and with greater frequency than students at the comparison schools. An analysis of the variance between the 8th grade BWLI and comparison school students showed that the more frequent technology use reported by BWLI students represented a statistically significant difference ($p<.001$) across all uses except using a computer to "play games", and "help teacher fix a computer problem". Like the student results for the 6th and 7th grade, the grade 8 results show that there was substantially more frequent technology use in the BWLI 8th grade classes than in the comparison schools for nearly all measured technology uses.

Across the BWLI 8th grade classes, students generally reported that using a computer to "find information on the Internet", "access a teacher's website", and "take notes in class" were among the most frequently occurring student uses. However, like the results from grades six and seven, notable differences were observed across the patterns of eighth grade computer use in the BWLI schools. For example, the frequency of students "accessing a teacher's web site", "finding information on the Internet" and "taking a test, quiz, or practiced test" was reported to vary widely across the BWLI 8th grade classes.

Below, this same survey data is explored across all grade levels for BWLI and comparison students. Table S15 shows the number of times during the 2006–2007 school year that students reported using a variety of specific technology uses during the 2006–2007 school year.

Table S15: Number of times during the 2006–2007 school year that students across all grade levels reported using a variety of specific technology applications in school

	Conte	Herberg	Reid	St. Mark	St. Joe	North	South
In the last year how often did you use a computer in school to:							
Find information on the Internet	98	94	91	119	58	43	41
Access a teacher's web site	86	63	54	55	7	4	6
Play computer games	46	17	40	47	10	18	24
Take notes in class using a computer	31	33	41	34	31	4	5
Edit papers using a computer	21	35	36	38	14	13	18
Create a Hyperstudio/PowerPoint presentation	38	22	24	29	17	9	6
Solve problems	28	29	30	25	12	7	13
Write first drafts	23	29	30	29	9	10	14
Take a test, quiz, or practice test	29	27	33	23	6	6	17
Present information to the class	25	19	19	19	12	8	7
Help a student fix a computer problem	15	14	15	31	11	6	9
Analyze data	18	14	20	19	6	6	6
Create graphs or tables	19	11	20	14	6	6	5
Keep track of dates and schedule/ calendar	14	17	14	17	6	2	2
Send and receive email	5	17	22	7	7	5	6
Work with spreadsheets/databases	16	8	14	11	5	4	5
Help a teacher fix a computer problem	8	8	6	6	6	5	4
Email a teacher	4	9	14	0	2	1	2

Summarizing the grade by grade analyses of student use presented in Tables S12, S13, and S14, this table represents thousands of students' survey responses to provide an estimate of the frequency of these specific types of technology across the five BWLI schools and the two comparison schools. As Table S15 shows, BWLI students used technology across a wide variety of applications and with substantially greater frequency than students in the comparison schools. Again, like the previously presented results and the individual grade level comparisons, there was often substantial variation in the frequency of technology use across the five BWLI schools.

When looking at the cumulative results across all of the technology use categories in Table S15, Conte, Reid, and St. Mark students exhibited the highest frequency of specific technology uses per student, trailed slightly by Herberg students. St. Joe students reported the least frequent use of technology of any BWLI school, although still considerably greater than either of the comparison schools.

The table also allows for the comparison of the most-frequently occurring technology uses (found at the top of the table) to the least frequently occurring uses (found at the bottom of the table). By far, the most frequently reported technology use at both BWLI and comparison schools was using a computer "to find information on the Internet". Other frequent uses of technology in the 1:1 settings included using a computer to: "access a teacher's web site", "play computer games", "take notes in class" and "edit papers using a computer". Some of the least frequent in-school technology uses during the 2006–2007 school year included using a computer "take a test, quiz, or practice test", "work with spreadsheets/databases", and "send and receive email".

Year 1 and Year 2 Comparisons

Up until now all of the student survey data examined in this report explored the differences between patterns of technology use across grade levels, across subject areas, and across the BWLI and comparison schools from the second year of BWLI deployment, the 2006–2007 school year. However, student data was collected in BWLI and comparison schools before the 2006–2007 school year which allows for further exploration of how computer use and teaching and learning practices have changed since the students began using laptops across the BWLI schools.

Before the data from past survey administrations can be compared to past results, survey data from the January 2006 7th grade survey and from the school wide May 2006 survey needed a mathematical transformation to conform to the technology use scale used in the May/June 2007 survey. This transformation is the result of a change in the way the student survey collected information about students' use of computers. Specifically, a methodological improvement was made to the May/June 2007 student survey, which provided much broader and more realistic response options for students to describe the frequency of their technology use both at home and at school.

In the pre-2007 student surveys, the student survey response options consisted of five discrete categorical response options: "never", "every couple of months", "once a month", "once a week", and "everyday". When the data was analyzed a numeric value was assigned to each response option such that "never" was coded as a zero and "every day" was coded as four. This common practice of assigning linear numeric values to survey responses allows for empirical analyses across schools

and over time. However, from a measurement point of view, the values assigned to the preceding surveys were somewhat arbitrary (with the exception of zero which indicated that a student never used technology). Although nearly all educational research has employed the use of such discrete categorical response options on surveys, the Boston College researchers recognized an opportunity to provide students with a more expansive (and more accurate) means of reporting the frequency of their computer use. Custom designed Macromedia Flash sliding scales were imbedded within the online student survey beginning with the May/June 2007 surveys. The "sliding scales" presented survey respondents with a visually accurate scale where they could quickly select the frequency of technology use on a 180 point scale representing the potential 180 days in the school year. In earlier pilot testing for these new scales, the Boston College researchers learned that responses on such scales were most accurate when the original categorical response option text (i.e. "never", "every couple of months", "once a month", etc.) was presented in addition to the numeric equivalent (0-180) on screen (http://nimbletools.com/).

With these Macromedia Flash response options, students can select any value on a 180-point scale using their mouse to drag an arrow across a sliding scale. In every case, the same survey questions and categorical response names were presented, but the May 2007 survey provided students with more realistic and accurate response options. However, to compare past categorical survey data with data collected using the full 180-point scale, the old data must first be converted to the 180 point scale. Assuming that the 2006–2007 school year equaled 180 days, or 9 months, or 36 weeks, the old five point scale was transposed to a 180 point scale to provide an equivalent estimate of computer use across survey administrations. This approach results in a 180 point scale where 0 represents a teacher never using technology and 180 represents *everyday* use of technology. Table S16, below, shows the conversion chart used to transpose the January 2006 and May 2006 student data onto the 180-point technology use scale.

Table S16: Conversion table for transposing the 1/06 and 5/06 student survey data to 180-point scale

1/06 and 5/06 raw data	Response Choice	Assigned value (12/07 analysis)
0	Never	0
1	Every couple of months	5
2	Once a month	9
3	Once a week	36
4	Every day	180

This 180-point scale provides easier interpretation and presentation of summary data because the difference between the numbers actually reflects a real difference in the amount of attribute measured (Glass & Hopkins, 1996). However, the accuracy attributable to the May 2007 data (bolstered as well by the excellent Year 2 response rates) does not extend to the prior student survey

data, despite the fact it can be presented on a 180-point scale. However, the figures and analyses presented below provide a detailed and accurate representation of students technology use across each grade before laptops were deployed and again at the end of the 2006–2007 school year.

In the following results, summaries of BWLI and comparison school students' frequency of various technology uses are reported over multiple survey administrations. Given that the BWLI student laptop deployment was staggered across grade levels, the corresponding pre- and post- laptop student surveys followed the same schedule. Thus, the figures below are presented for individual grade levels and subject areas before whole school summaries are presented. The individual trends across schools for pre- and post- student laptop averages are interesting in that they allow a more direct comparison across the BWLI schools and comparison schools than had been possible when only Year 1 data was available. For example, Figure S4 shows the average number of days students used technology in their classrooms across past survey administrations.

In addition to providing a summary of the technology use in the classroom, Figure S4 also displays the overall structure of the available longitudinal data. Only 7th graders completed the first January 2006 survey as the first year of the BWLI program provided laptop computers only to grade seven students beginning in early 2006. At the end of the 2005–2006 school year students across all grade levels completed a survey. So, the May 2006 survey is a pre-laptop survey for 6th and 8th grade students but reflects approximately four months of 7th graders in 1:1 classrooms. It was an unfortunate coincidence that no 7th grade students from either comparison school completed the May 2006 survey due to a scheduling error at the end of the 2005–2006 school year. However, 7th grade pre/post comparisons can be made using the subsequent June 2007 survey collected from both BWLI and comparison school 7th graders. Given the interim nature of this Year 2 document, it should be noted that final student and teacher surveys will be collected in June 2008 across all grade levels in BWLI and the comparison schools.

Figure S4: Average number of days students reported using technology in their classrooms across past survey administrations

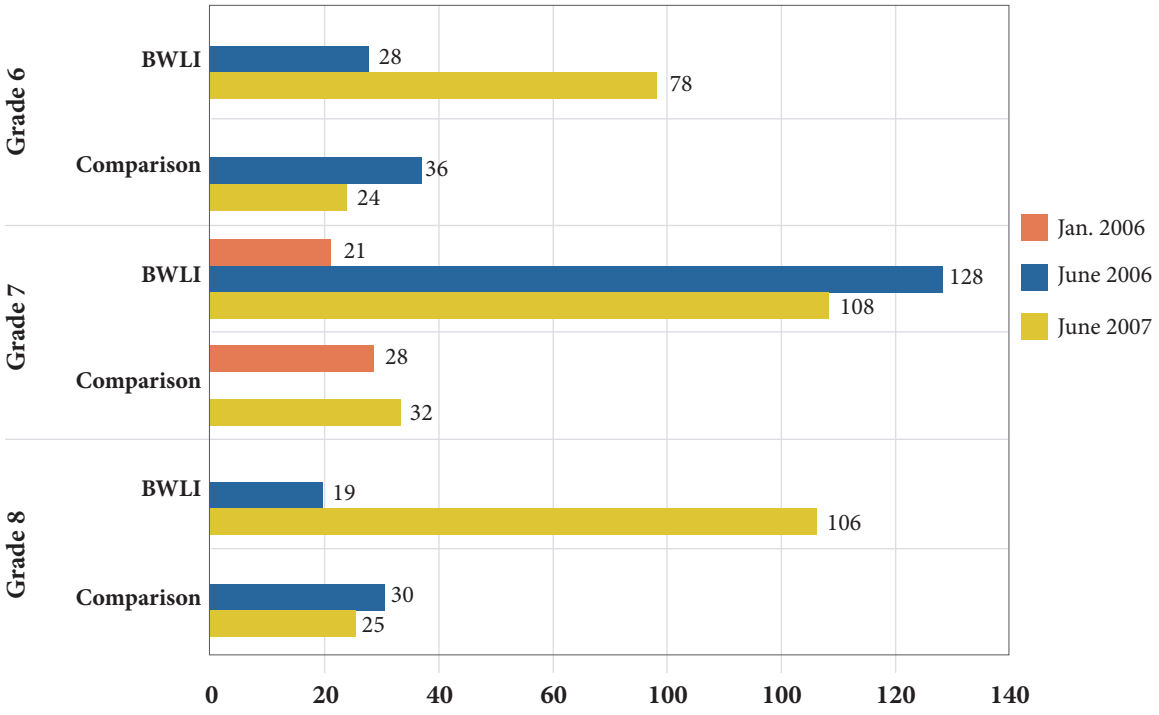


Figure S4 displays the average number of days students reported using technology in their classrooms across all past survey administrations (Jan. 2006, June 2006, and June 2007). Overall, it is clear from viewing Figure S4 that there were substantial increases in the frequency of technology use for BWLI students between their pre-laptop surveys and their post-laptop surveys. This increased use is found across all grade levels for BWLI students while in-class technology use in the comparison schools changed little. For example, in grades 7 and 8 there was almost a five-fold increase in the frequency of technology use in the classroom reported by the BWLI students while sixth graders reported a less substantial increase between survey administrations. Figure S5 begins a grade by grade analysis of students' reported technology use since the beginning of the BWLI program with a summary of the number of days that BWLI and comparison 6th grade students reported using computers across their primary subject classes.

Figure S5: Number of days in the 2005–2006 and the 2006–2007 school year that BWLI and comparison 6th grade STUDENTS reported using computers across their primary subject classes

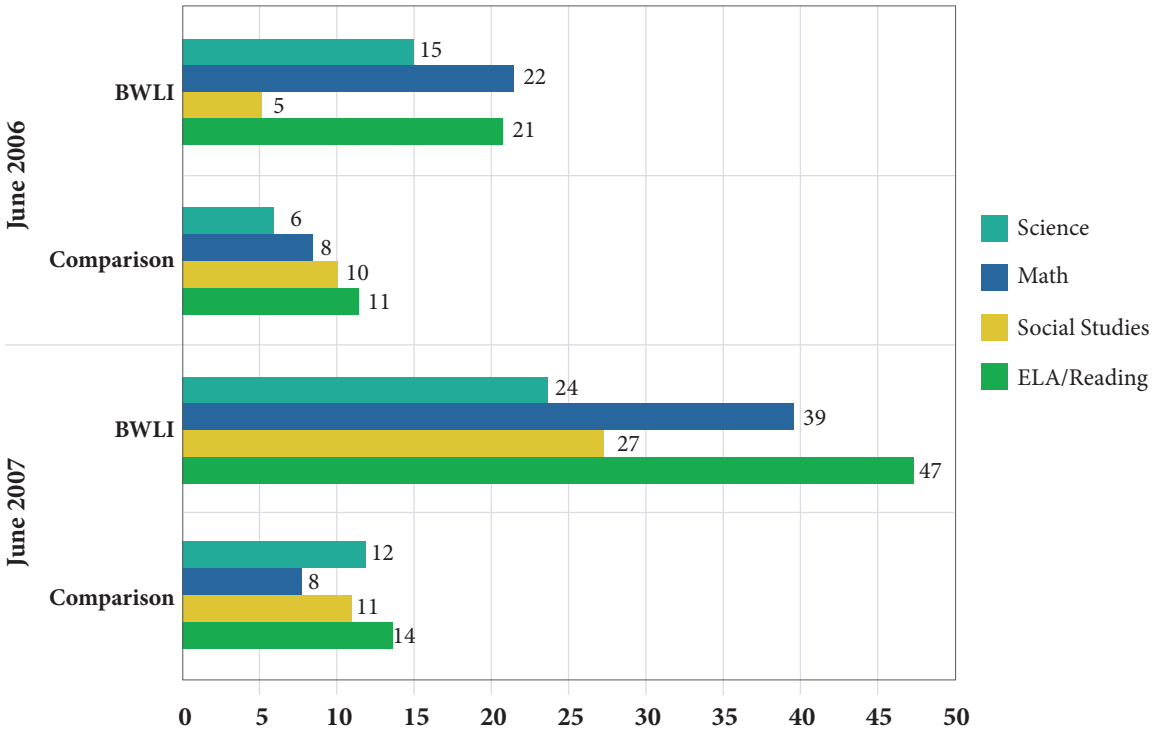
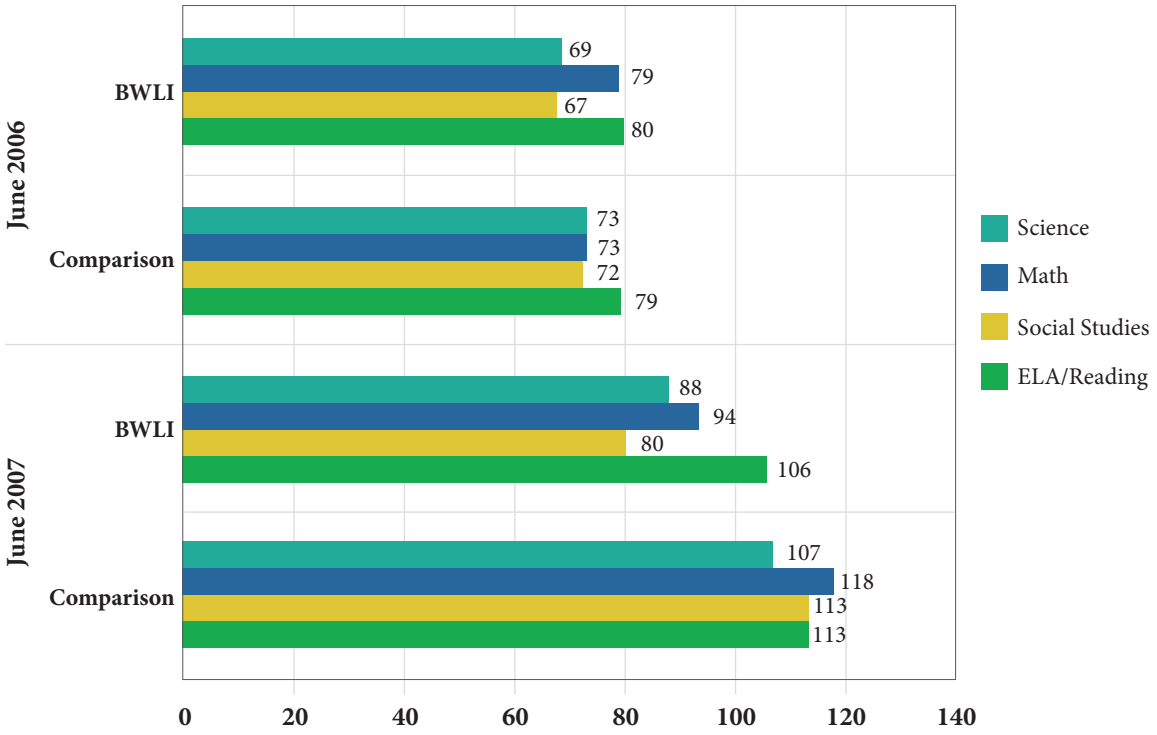


Figure S5 shows the number of days that BWLI and comparison school 6th grade students reported using computers in their primary subject classes. Specifically, average sixth grade students' use of technology across Reading/ELA, Social Studies, Math, and Science classes are compared from June 2006 when no sixth grade students had been issued laptops to the June 2007 survey after sixth grade students had 1:1 laptops for approximately five months at each BWLI school.

Accordingly, the average sixth grade students' use of technology in the BWLI settings was greater in all surveyed subject areas during the second year of the BWLI program while the comparison group students reported fewer increases in their use of technology during this same period. However, despite this general increase in computer use, there are some interesting patterns that are worth greater consideration and discussion. For example, looking at only the June 2006 results (pre-1:1 laptops), we see that the BWLI sixth grade students reported using computers about twenty times per year in their Math and Reading/ELA classes, while about 15 times per year in their Science classes and only 5 times in Social Studies. Comparison students during this same period report less overall computer use in every subject concentration except Social Studies where the June 2006 average was 10 times per year. Looking now at the June 2007 sixth grade survey results (post- 1:1 laptops), BWLI students reported widespread and dramatic increases in the frequency of their computer use, although the relative pattern of use across classes remains similar. Specifically, sixth grade

BWLI students reported using computers nearly 50 times per year in Reading/ELA, nearly 40 times per year in Math, while about 25 times per year in their Science and Social Studies. Comparing pre to post-laptop results, we see BWLI students reported the largest proportional increase for Social Studies classes where average computer use witnessed a five-fold increase. Figure S6, below, continues this exploration of pre/post sixth grade computer use by exploring the number of days that BWLI and comparison 6th grade teachers were reported by their students to be using computers across their primary subject classes in both the 2005–2006 and the 2006–2007 school year.

Figure S6: Number of days in the school year that BWLI and comparison students reported that their 6th grade TEACHERS used computers in their primary subject classes



It should be noted here that all BWLI teachers were provided their own laptops early in the 2005–2006 school year so that both survey administrations represent learning settings where teachers in the BWLI schools had laptop computers. Thus, Figure S6 illustrates the difference between teachers' use of technology with their students during a time period when student access to technology increased at the BWLI schools but not in the comparison schools.

Although BWLI teachers increased the frequency of technology use in every surveyed subject area, the differences over time in sixth grade teachers' use of technology presents a more complicated story than the sixth grade student results. For example, results from the June 2006 survey show quite similar patterns and frequency of technology use across both BWLI and comparison teachers.

Looking at the June 2007 survey results, after sixth grade BWLI students had access to laptops for about half the 2006–2007 school year, we observe a modest increase in the frequency of technology use across all subject areas in the BWLI setting. However, increases in the sixth grade comparison schools during the 2006–2007 were larger than those reported in the BWLI schools. Comparing the BWLI teachers' and comparison school teachers' use of technology collected during the June 2007 survey, we see that BWLI teachers used technology less than comparison school teachers in every surveyed subject area. Although, these differences are generally small they show that comparison group teachers were frequently using technology with students across all primary subject areas during the 2006–2007 school year. Based upon the BWLI student results, BWLI 6th grade teachers used technology most frequently in Reading/ELA (106 times per year) and least frequently in Social Studies classes (80 times per year). Sixth grade comparison school teachers were reported to use technology most frequently in Math classes during the 2006–2007 school year (118 times per year).

Figure S7: Number of days in the school year that BWLI and comparison 7th grade STUDENTS reported using computers across their primary subject classes

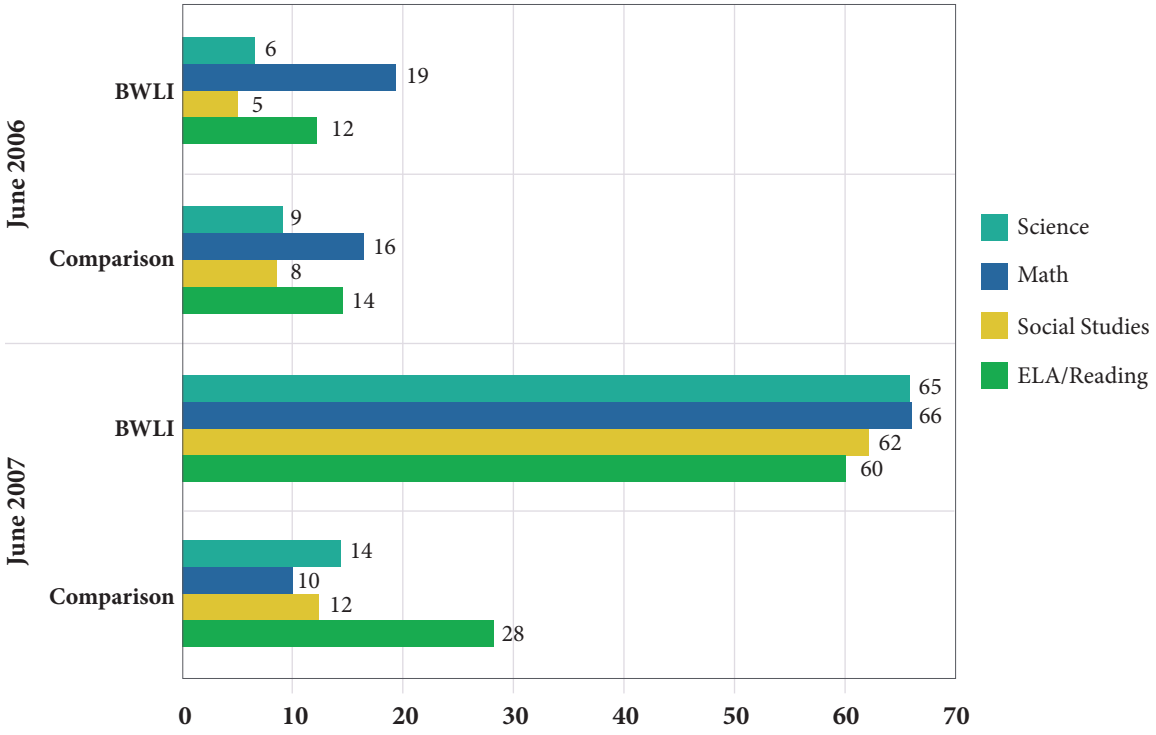


Figure S7 shows the number of days that BWLI and comparison school 7th grade students reported using computers in their primary subject classes. Specifically, average seventh grade student use of technology in Reading/ELA, Social Studies, Math, and Science classes from the January 2006 survey (before 7th grade students had been issued laptops) is compared to the June 2007 survey after BWLI 7th grade students had 1:1 laptops for a full school year.

Accordingly, the average seventh grade students' use of technology in the BWLI settings was substantially greater in all surveyed subject areas during the second year of the BWLI program while the comparison group students reported general decreases in their use of technology during this same period. Despite this robust increase in computer use for BWLI students, there are some interesting patterns that are worth greater consideration and discussion. For example, looking at only the January 2006 results (pre-1:1 laptops), we see that the BWLI seventh grade students reported using computers about twenty times per year in their Math classes, while 12 times per year in their Reading/ELA classes and approximately 5 times in Social Studies and Science. Comparison students during this same period report quite similar computer use in every subject area to BWLI students with most frequent use reported in Math and Reading/ELA classes. Looking to the June 2007 seventh grade survey results (post- 1:1 laptops), BWLI students reported widespread and dramatic increases in the frequency of their computer use, with the greatest use now reported for Math and Science classes. More specifically, seventh grade BWLI students reported using computers 60 or more times per year in each surveyed subject area with the largest proportional increases observed for Science and Social Studies class averages. In the comparison schools, such substantial increases were not observed, although the frequency of computer use in Reading/ELA classes doubled between the January 2006 and June 2007 surveys. Figure S8, below continues this exploration of pre/post seventh grade computer use by exploring the average number of days that BWLI and comparison 6th grade teachers were reported to use their computers across their primary subject classes in both the 2005-2006 and the 2006-2007 school year.

Figure S8: Number of days in the school year that BWLI and comparison students reported that their 7th grade TEACHERS used computers in their primary subject classes

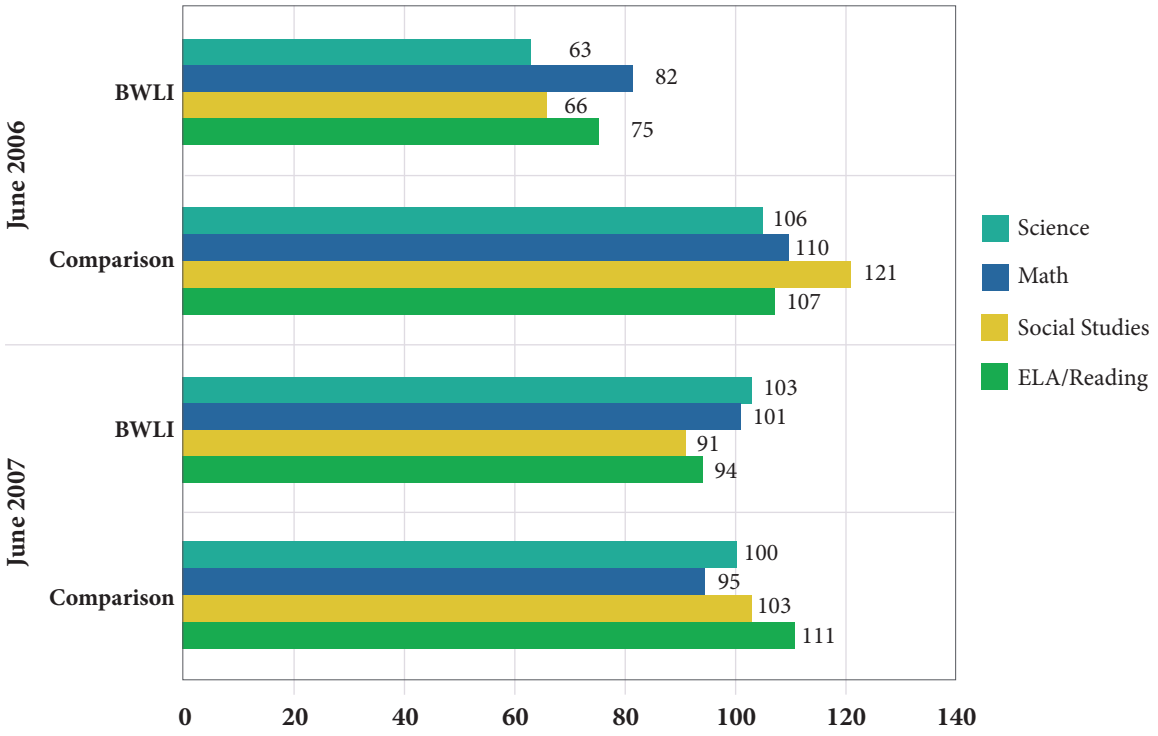


Figure S8 shows the average number of days that 7th grade teachers were reported to use technology across four primary subject areas. Specifically, seventh grade teachers' use of technology in Reading/ELA, Social Studies, Math, and Science classes are compared from the January 2006 survey (before 7th grade students had been assigned laptops) to the June 2007 survey after the BWLI 7th grade students had 1:1 laptop access for the majority of the 2006/2007 school year. It should be noted again that all BWLI teachers were provided their own laptops early in the 2005–2006 school year so that both survey administrations represent learning settings where teachers in the BWLI schools had laptop computers. Thus, Figure S8 illustrates the difference between teachers' use of technology with their students during a time period when student access to technology increased at the BWLI schools but not in the comparison schools.

Although BWLI teachers increased the frequency of technology use in every surveyed subject area, the differences over time in seventh grade teachers' use of technology were less robust than the seventh grade student results. For example, results from the January 2006 survey show that comparison school teachers were using technology with much greater frequency than BWLI teachers across all surveyed subject areas. Looking at the June 2007 survey results, after seventh grade BWLI students had access to laptops for the duration of the 2006–2007 school year, we observe a marked increase in teachers' frequency of technology use across all subject areas in the BWLI setting. However, the comparison school seventh grade teachers' use during the 2006–2007 decreased slightly since the January 2006 averages. Comparing the BWLI teachers and comparison school teachers' use of technology collected during the June 2007 survey, we see that BWLI teachers used about the same amount as comparison school teachers. Based upon the BWLI 2006–2007 results, BWLI 7th grade teachers used technology most frequently in Science (103 times per year) and least frequently in Social Studies classes (91 times per year). Seventh grade comparison school teachers were reported to use technology most frequently in Reading/ELA classes during the 2006–2007 school year (111 times per year).

Figure S9: Number of days in the school year that BWLI and comparison 8th grade STUDENTS reported using computers across their primary subject classes

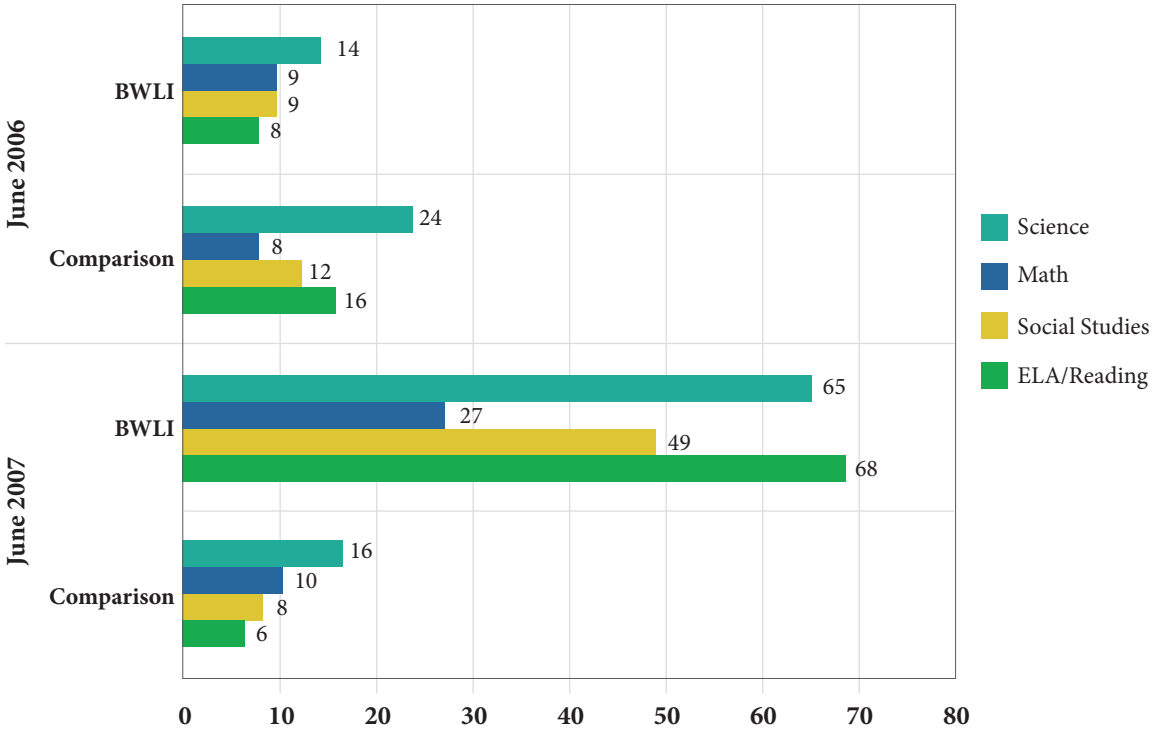


Figure S9 shows the average number of days that BWLI and comparison school 8th grade students reported using computers in their primary subject classes. Specifically, 8th grade student use of technology in Reading/ELA, Social Studies, Math, and Science classes are compared from the June 2006 survey (before 8th grade class had been assigned laptops) to the June 2007 survey after the BWLI 8th grade students had 1:1 laptop access for the better half of 2006–2007 school year.

Accordingly, the average eighth grade use of technology in the BWLI settings was greater in all surveyed subject areas during the second year of the BWLI program while the comparison group students reported mixed results in their use of technology during this same period. Despite these major increases in the frequency of computer use for BWLI students, there are some interesting patterns worthy of further discussion. For example, looking at only the June 2006 results (pre-1:1 laptops), we see that the BWLI eighth grade students reported using computers 14 times per year in their Reading/ELA classes, while less than ten times per year in their Math, Science, and Social Studies classes. Comparison students during this same period reported fairly similar computer use to the BWLI students, however, they actually reported somewhat more frequent technology use across nearly all of the surveyed subject areas than BWLI students.

Summarizing the June 2007 eighth grade survey results (post- 1:1 laptops), BWLI students reported widespread and dramatic increases in the frequency of their computer use, with the

most frequent use now reported for Science and Reading/ELA classes, which averaged 65 or more times per year. Eighth grade BWLI students reported using computers nearly 50 times during the 2006–2007 school year in their Social Studies classes and 27 times in their Math classes. In the comparison schools, the frequency of technology use generally decreased between the June 2006 and June 2007 surveys.

Figure S10, below, completes the exploration of pre/post eighth grade computer use by exploring the number of days that 8th grade teachers were reported by their students to be using computers across their primary subject classes in both the 2005-2006 and the 2006-2007 school year.

Figure S10: Number of days in the school year that BWLI and comparison students reported that their 8th grade TEACHERS used computers in their primary subject classes

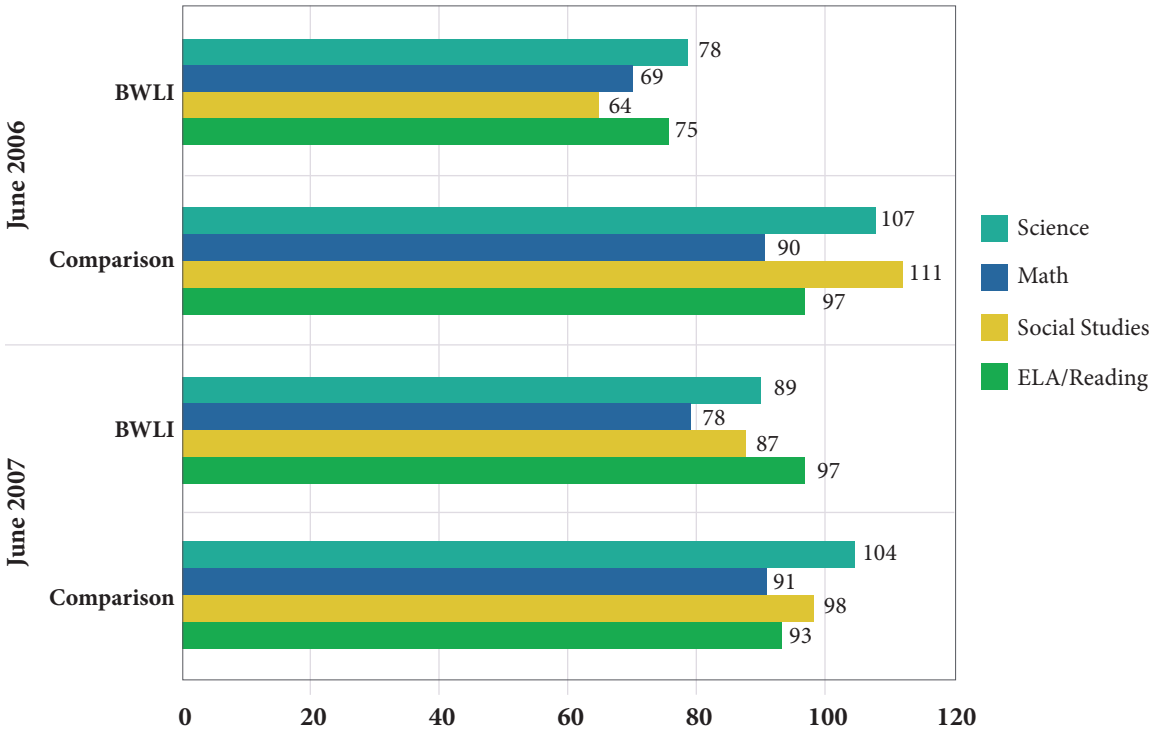


Figure S10 shows the average number of days that 8th grade teachers were reported by their students to use technology across four subject areas. Specifically, eighth grade teachers' average use of technology in Reading/ELA, Social Studies, Math, and Science classes is examined from the June 2006 survey (before 8th grade students had been assigned laptops) and from the June 2007 survey (after the BWLI 8th grade students had 1:1 laptop access for the better half of 2006–2007 school year). It should be noted again that all BWLI teachers were provided their own laptops early in the 2005–2006 school year so that both surveys represent learning settings where teachers in the BWLI schools had laptop computers. Thus, Figure S10 illustrates the difference between teachers' use of

technology with their students during a time period when student access to technology increased at the BWLI schools but not in the comparison schools.

Although BWLI teachers increased the frequency of technology use in every surveyed subject area, the differences over time in eighth grade teachers' use of technology were again less robust than the eighth grade student results. For example, results from the June 2006 survey show that comparison school teachers were using technology with greater frequency than BWLI teachers across all surveyed subject areas. Looking at the June 2007 survey results, after eighth grade BWLI students had access to laptops for the majority of the 2006–2007 school year, we observe increases in teachers' frequency of technology use across all subject areas in the BWLI setting. However, the comparison school eighth grade teachers' use during the 2006–2007 year was unchanged or decreased slightly since the June 2006 averages. Comparing the BWLI teachers' and comparison school teachers' use of technology collected during the June 2007 survey, we see that BWLI teachers used computers about the same amount as comparison school teachers. Based upon the BWLI 2006–2007 results, BWLI 8th grade teachers used technology most frequently in Science (97 times per year) and least frequently in Math classes (78 times per year). Like the 7th grade results, 8th grade comparison school teachers were reported to use technology most frequently in Reading/ELA classes during the 2006–2007 school year (104 times per year).

Students' Home Access to Technology

In addition to surveying students' use of technology in school, the June 2007 student survey also measured students' access and use of computers at their home during the 2006–2007 academic year. In the following tables, BWLI and comparison students' access to a home computer is examined across each of the BWLI and comparison schools using the June 2007 student survey results. To begin this exploration of computer use outside of school, Table S17 shows the average estimated number of home computers across BWLI and comparison students.

Table S17: Average number of home computers across BWLI and comparison schools during the 2006–2007 school year

	Conte	Herberg	Reid	St. Mark	St. Joe	North	South
How many computers (including a school laptop) do you have at home?							
0	7%	3%	5%	1%	2%	4%	8%
1	24%	13%	19%	5%	8%	33%	33%
2	32%	38%	34%	32%	37%	30%	30%
3 or more	37%	46%	42%	63%	53%	33%	29%

Although there are small differences across each of the BWLI and comparison schools, students overwhelmingly reported that they had one or more computers available to them at their home. Across all student survey respondents, only 5% of all survey respondents reported that they had no

access to a computer at home. Interestingly, looking at statewide survey data collected by the Massachusetts Department of Education similarly revealed that the 95% of the state's 70,000 8th grade public school students reported having at least one home computer in a Spring 2007 Questionnaire (2007 State Questionnaire Summary; Grade 8 Results Excel Report). In other words, the sample of students from the BWLI and comparison schools looks highly similar to the state average in terms of home access to computers.

Across all of the schools, the percent of students who report no access to a computer at home ranged from 1% at St. Mark to 8% at South. Despite the relative similarity in the BWLI and comparison school results, the results summarized in Table S17 requested that students include in their home computer estimate any school-issued computer if they were being taken home frequently. Given that all BWLI students had a theoretical chance of taking home a school laptop that was rarely, if at all, afforded to comparison school students, it is not surprising to see the biggest differences between the student averages in home computer access was with three or more computers. A more detailed examination of the percent of BWLI students who took school laptops home with them is presented below in Table S18.

Table S18: Percent of students who reported taking a school laptop home with them during the 2006–2007 school year

	Conte	Herberg	Reid	St. Mark	St. Joe	Total Comparison	Total BWLI
Every Day	4%	45%	39%	74%	47%	1%	37%
Once a Week	4%	2%	1%	1%	4%	2%	1%
Once a Month	3%	1%	1%	0%	0%	0%	0%
Every Couple of Months	2%	1%	1%	0%	0%	1%	1%
Never	87%	52%	58%	25%	50%	97%	59%

Table S18 illustrates the percent of students who reported taking a school laptop home with them during the 2006–2007 school year. In this survey item, students were simply asked to select from five response options on "How often do you take a school computer home with you?" In addition to reporting how regularly students took a school laptop home with them during the second year of the BWLI implementation at each school, the table above also allows a summary of the cumulative take home rates across the BWLI and comparison schools. Overall, 97% of comparison school students reported that they "never" took home a school computer while 59% of all BWLI students reported that they "never" took a school computer home despite their participation in the 1:1 laptop program at their schools. Across the BWLI schools, there was substantial variation in the percent of students who reported bringing home a school computer with only 4% of Conte students reporting that they bring their BWLI laptop home "every day" compared to 74% of St. Mark students. About half of the students at Herberg, Reid, and St. Joe reported that they brought their laptops home with

them "every day" during the 2006-2007 school year while the remaining half generally reported that they "never" brought a computer home from school.

Although more fully explained in the subsequent section on the effects of computer use and student achievement, analysts at Boston College merged the 2007 MCAS data set with the June 2007 BWLI student survey results. Such a combination allows for more extensive analyses of BWLI student characteristics and patterns of home access and use which revealed that the 40% of BWLI students who "never" brought their laptops home with them during the 2006–2007 school year generally had lower socio-economic status (based on free/reduced lunch eligibility) and fewer computers already at home. In other words, those students who have less resources at home are the often the same students who are not taking home BWLI laptops. A more detailed analysis of student home access and use will included in the Year 3 BWLI student report. Furthermore, the current 2007–2008 school year estimates from each BWLI school on the current take home rates is summarized in the Introduction section of the current paper. Table S19, below, continues the exploration of student access to technology during the 2006–2007 school year by examining students' ease of access to a computer at their home.

Table S19: Students ease of access to a home computer during the 2006–2007 school year

	Conte	Herberg	Reid	St. Mark	St. Joe	North	South
When you are at home, how difficult is it for you to use a computer when you want to?							
Often Difficult	5%	7%	9%	5%	5%	3%	6%
Sometimes Difficult	36%	31%	29%	29%	28%	24%	28%
Never Difficult	59%	63%	62%	67%	67%	73%	66%

Table S19 shows a summary of student responses[2] to a June 2007 survey item asking "When you are at home, how difficult is it for you to use a computer when you want to". Averages across the BWLI and comparison group schools provide an estimate of students' ease of access to a computer at their home. Across all of the schools, students at the North School reported the least amount of difficulty with 73% of responding students reporting that they "never" have difficulty accessing a computer at home. However, despite some differences across the schools, BWLI and comparison school students overwhelmingly report that they experience relatively little difficulty in accessing a computer when they are at home. Despite efforts to have students take BWLI laptops home with them during the 2006–2007 school year, the survey results from the end of Year 2 implementation show that comparison school students generally had the same or less difficulty accessing a home computer. Lastly, in Table S20, below, is the percent of students' access to the Internet from their home computer during the 2006–2007 school year.

Table S20: Percent of students' access to the Internet from their home computer during the 2006–2007 school year

	Conte	Herberg	Reid	St. Mark	St. Joe	North	South
What type of internet connection do you have at home?							
No home Internet	7%	6%	8%	8%	3%	3%	4%
Modem	14%	11%	12%	9%	10%	12%	15%
DSL or high speed	59%	55%	52%	51%	53%	65%	64%
Not sure	20%	28%	28%	32%	33%	21%	18%

Table S20 shows the average percent of students' home access to the Internet across each of the BWLI and comparison schools during the 2006/2007 school year. Overall, students in all of the schools overwhelmingly reported that they had an Internet connection on their home computer. In addition, the majority of students at each school reported their home computer was connected to the Internet with high speed /DSL connection while fewer than 15% of students reported having a modem connection.

From Tables S17–S20 it is clear that BWLI and comparison school students had similar access to technology at their homes, despite the fact that BWLI students had more opportunity to bring school technology home. Specifically, the vast majority (about 95%) of students reported having at least one computer accessible at home which was likely connected to the Internet. In addition to the degree to which students could access a home computer, students were also asked to reflect on typical amount of time they use a computer while at home. The following section briefly summarizes students' use of technology at home during the 2006–2007 school year.

Students' Home Use of Technology

The tables below summarize students' frequency and use of computers at home during the 2006–2007 school year. This summary begins with the average number of minutes that students estimated they spent using their home computer on a typical school day and a typical non-school day (weekend, vacation, etc.). Table S21, next page, presents these summarized results across each of the BWLI and comparison schools.

Table S21: Average number of minutes students reported using their home computer on a typical day during the 2006–2007 school year

	On a typical *school day* how many minutes would you say that you spend using a computer at home?	On a typical *day when you don't have school* (weekend, vacation, etc.) how many minutes would you say that you spend using a computer at home?
Conte	62	71
Herberg	58	67
Reid	64	74
St. Mark	54	64
St. Joe	61	70
North	57	71
South	57	71

Table S21 shows the average number of minutes that students reported they used their home computers during the 2006–2007 school year. Specifically, Table S21 shows the average number of minutes that students across the BWLI and comparison schools used computers on a typical school day and on a typical non-school day. Overall, across the students who reported having at least one computer at home (95% of all June 2007 survey respondents) they reported to use their home computer approximately one hour per day, on average, although many students reported more or less frequent technology use. For example, additional analyses showed that older students in both BWLI and non-laptop settings typically used their home computer more frequently then the younger students reported. Thus, the frequency of home computer use increased as grade level increased. In addition, students across all schools reported that they generally used their home computers more frequently on days when they don't have school than on typical school days. A more detailed investigation of home computer use is reported in Table S22, which shows the average number of minutes that students estimated they spend using their home computers for a wide variety of tasks.

Table S22: Average number of minutes students reported using their home computer on a typical day for a variety of uses during the 2006–2007 school year.

	Conte	Herberg	Reid	St. Mark	St. Joe	North	South
How many minutes would you say that you use a computer at home to:							
Chat/instant message	49	47	55	36	49	47	52
Search the Internet for fun	33	37	43	41	38	39	42
Play games	33	29	34	41	25	30	35
Write papers for school	25	34	30	39	31	26	24
Download music/mp3's	31	26	31	18	25	34	38
Use email	27	26	34	20	19	26	30
Search the Internet for school	22	29	23	28	20	21	20
Create or maintain web pages	17	14	22	10	15	17	20
Create your own music or video projects	12	17	20	19	12	12	17
Shop online	11	7	12	7	14	12	13

Table S22 displays the average number of minutes that students reported using their home computer on a typical day for a variety of uses during the 2006–2007 school year. Overall, we can see from Table S22 that students across each of the schools used their home computer for a wide variety of purposes during the second year of the BWLI implementation. Across all schools except St. Mark, students reported the most time was spent using a home computer to "chat/instant message" with school averages reported between 45 and 55 minutes on a typical day. Students also reported frequent use of their home computer to "search the Internet for fun" and "play games". Students at the BWLI schools generally reported more time devoted to academic tasks on their home computer than students across the two comparison schools. Specifically, students in the BWLI settings reported somewhat more frequent use of their home computer to "write papers for school" and "search the Internet for school". Less frequent use was reported by students, on average, for using their home computer to "shop online", "create your own music or video projects", and "create or maintain web pages". Looking cumulatively across all the measured home technology uses, it is clear that many students are multi-tasking with their home computer time performing various tasks simultaneously, such as downloading an mp3 while chatting with friends and searching the Internet for fun or school.

Given the widespread reported use of home computers by students to chat and instant message, the June 2007 student survey included a short section on students' experience and behaviors while chatting and instant messaging during the 2006–2007 school year. The survey items were developed and analyzed by a team that included Williams Colleges' faculty member Marlene Jacobs

Sandstrom, Massachusetts College of Liberal Arts faculty member Maria Bartini, and Boston College's Damian Bebell. The analyses of these results are being used to create a measurement scale for future research that serves to categorize and document student experience with this newly emerging social use of their home computer. The results of this early was presented at the March 2008 meeting of the Society for Research on Adolescence in Chicago, IL. Appendix A contains the abstract "Gender and Grade Differences in Internet Aggression: Development of the eBehavior Scale" for additional information about this newly emerging research.

Exploring the Impacts of Computer Use and Student Achievement

Despite the massive investments that federal, state, and local agencies devote to educational technology expenditures and initiatives, there remain few empirical studies that explore the relationship between students' and teachers' use of technology and their performance on measures of student achievement. This lack of rigorous research is particularly conspicuous at a time when nearly all educational ideas and programs are being evaluated by policy makers and educational leaders for their impact on standardized local and state level assessments. One of the biggest reasons for this lack of research is the inherent complexity and difficulty involved in measuring emerging technology practices in 1:1 settings and associating them with measures of student achievement. The current BWLI research and evaluation efforts aim to explore the relationship between students' and teachers' use of technology and students' performance on Massachusetts' mandatory state assessment, the MCAS. Specifically, at the end of three years of 1:1 computing, data collected from student surveys will be merged with state assessment results to explore how varied technologies practices have impacted student achievement across the BWLI public schools.

Given the high degree of interest in student outcomes emerging from 1:1 settings, preliminary data collected during the 2006–2007 school year is explored in the current paper to show if any emerging relationship is present between students' and teachers' use of computers and student MCAS scores. Although students experienced a relatively short deployment period of 1:1 computers, the following exploratory analyses provide some preliminary account of the complicated relationship between computer use and test performance. It should also be noted that the current analyses was conducted using only results from the MCAS state assessment, which is a paper and pencil exam that does not allow students to use computers at any time. A complete analysis of students' participation in the BWLI program, their use of technology, and student test performance is scheduled to be conducted after the third and final year of the laptop implementation in Summer 2008. In addition, a computer writing study is scheduled for January 2008 that will provide students an opportunity for students to demonstrate their writing ability *using their laptops* in an authentic testing session.

In the current paper, Year 2 student results from grades 7 and 8 were merged with Spring 2007 item level MCAS results provided to the research team by each participating school. Grade 6 results were not analyzed as 6th grade students had the least exposure to the BWLI program and student 1:1 computing and Spring 2007 BWLI student survey results suggested more frequent and regular technology use was occurring in grades 7 and 8. Because only public school students participated in the MCAS as a mandatory state assessment, only results from the three BWLI public schools

(Conte, Herberg, and Reid) and the two comparison schools were available for analyses. Thus, a new data set was created that included the state's MCAS results and demographic information as well as the BWLI student survey on technology use and practices. So, for each 7th and 8th grade student who completed the MCAS and the BWLI survey, the relationship between various technology uses and various outcome/student achievement measures could be examined. Table S23 provides demographic information from the newly merged 2006–2007 MCAS/BWLI data set for the seventh grade BWLI and comparison school students.

Table S23: Grade 7 achievement and demographic data from the state

	Conte	Herberg	Reid	North	South
% of Students eligible for free/reduced lunch	44%	32%	49%	19%	31%
% of non-white (A, B, H, M, N) students	13%	17%	25%	11%	18%
Mean ELA raw score	46.6	49.1	49.3	52.2	50.5
Mean Math raw score	32.2	35.2	31.7	34.7	32.3
# of Students who completed 2007 MCAS	126	263	211	240	224
# of Students who completed 2007 survey	115	257	202	146	187
# of Special education students (excluded)	29	41	33	38	35
Total number of students included in analyses	**92**	**218**	**173**	**132**	**160**

In addition to showing the mean MCAS scores across the each school's 7th grade class, the state data shows the percent of students who were eligible to receive free or reduced lunch (a common indicator of students' socioeconomic status), the percent of non-white students (an indicator for ethnic/racial diversity), the number of special education students, as well as the number of students who completed the May/June 2007 BWLI survey. Looking across the schools, MCAS scores were fairly similar although there was greater variance for the data summarizing the number of students who received free/reduced lunch or were classified by the state as non-white. Across each school, a number of students were reported to receive Special Education services. Although the majority of these students completed the BWLI survey and some version of the MCAS, they are excluded from the Year 2 achievement analyses to simplify the exploratory analyses. Lastly, Table S23 shows that the overwhelming majority of 7th grade BWLI students completed the May/June 2007 BWLI survey while a lesser percentage of comparison school students completed the survey. Table S24 shows a similar table describing various achievement and demographic summary statistics for grade 8 students.

Table S24: Grade 8 achievement and demographic data from the state

	Conte	Herberg	Reid	North	South
% of Students eligible for free/reduced lunch	44%	35%	53%	22%	34%
% of Students non-white (A, B, H, M, N) race	14%	17%	21%	10%	19%
Mean ELA MCAS raw score	34.2	36.2	35.7	36.4	37.6
Mean Math MCAS raw score	30.1	33.0	28.5	31.7	33.6
Mean Science MCAS raw score	30.4	29.1	28.5	32.1	31.8
# of Students who completed 2007 MCAS	137	241	231	258	253
# of Students who completed 2007 survey	127	240	196	213	203
# of Special education students (excluded)	34	54	51	42	47
Total number of students included in analyses	**98**	**201**	**163**	**184**	**174**

Table S24 shows a summary of demographic and student achievement data across the grade eight BWLI and comparison school students who completed the MCAS in Spring 2007. In addition to showing the mean MCAS scores across the each school's 8th grade class, the state data shows the percent of students who were eligible to receive free or reduced lunch, the percent of non-white students, the number of special education students, as well as the number of students who completed the May/June 2007 BWLI survey. Looking again across the schools, MCAS scores were fairly similar although there was greater variation in the data concerning the number of students who received free/reduced lunch or were classified by the state as non-white. Again, special education students were excluded from the 8th grade achievement analysis to simplify the statistical models. It should be noted that Year 3 analyses will include a separate statistical model for the analyses of factors that influence special education students test performance. In addition to the ELA and Math tests taken by both the 7th and 8th grade students, all 8th grade students in Massachusetts additionally completed a Science/Technology assessment in the Spring 2007 MCAS.

Exploratory data analyses were performed using the student data to investigate if the frequencies of teachers' and students' various technology uses (as measured by the BWLI student survey) exhibited any statistical relationship with the 2007 student achievement results. More simply, did any of students' specific uses of technology during the 2006–2007 year relate to their test performance? For example, did the students who reported more frequent use of technology for "creating graphs and tables" perform any better on the MCAS math section than students who rarely used technology for this purpose? Given the fact that there was such wide variation in many of the computer use measures across and between the BWLI and comparison school students, the current sample provides a rich data set for such preliminary explorations. Through such an analysis it is possible to get a cursory understanding of the complex relationship between student and teacher practices during the 2006–2007 school year and an objective measure of student achievement in Spring 2007. Through this type of analysis (including students from non-1:1 laptop settings in comparison

groups) it can also be shown if specific technology practices appear to be impacting test scores positively, negatively, or not at all. Such analyses are particularly appropriate given the cursory nature of this Year 2 data set as well as the wide range of student responses.

It is also important to caution the reader from making generalizations beyond this limited analysis of a preliminary data set. Given the wide variety of student experiences reported in the teacher and student survey results, it is clear that learning conditions differ dramatically across each school as do individual reform models and other widely applied practices to improve student achievement and test performance. It is clear to most members within the school communities that the BWLI program is positively affecting many aspects of teaching and learning as routinely expressed in the school visits and the teacher survey results. However, years of educational evaluation and research have provided few concrete examples of specific technology practices having a direct impact on students test performance. In the tables that follow, the correlation between specific individual technology uses and student MCAS scores are presented. Both BWLI and comparison group students are analyzed separately given that technology practices may be different in 1:1 and non-1:1 settings. In addition, individual analyses were run independently on 7th and 8th grade results. Although not presented in the current document, individual regression models were also created for each school that included both demographic and technology use data to predict which students would be most likely to succeed on the state tests. These individual school models are currently being replicated before being distributed to the participating schools for their own reflective and formative reflection.

In the following analyses, the relationship between BWLI teachers' and students' use of technology and MCAS performance is demonstrated using Pearson's correlation coefficients (*r*). For those readers unfamiliar with examining relationships between variables using correlation, accepted guidelines for interpreting the r values are reproduced below from Guilford's (1954) Psychometric Methods.

Table S25: Interpretation of correlation coefficient

r Value	Interpretation
Less than .20	Slight; almost negligible relationship
.20 – .40	Low correlation; definite but small relationship
.40 – .70	Moderate correlation; substantial relationship
.70 – .90	High correlation; marked relationship
.90 – 1.00	Very high correlation; very dependable relationship

In the following example a positive correlation indicates that as students' use of technology increased, so did their 2007 MCAS score. A negative relationship would indicate that as students' use of technology increased, their test performance decreased. A common method for evaluating the strength of a correlation is to test the value for statistical significance. Significance testing provides an indication of the strength of the relationship and whether the relationship can be attributed to chance. For the correlation tables of student results presented in the current paper, correlation values found to be statistically significant are depicted in bold (p.<.05, 2-tailed test). Again, these correlation results are not intended to determine the effectiveness of the BWLI program or its various components, but rather to explore what student and teacher uses may be related to a common measure of student achievement. In the tables below, the correlation between Year 2 technology uses and Spring 2007 MCAS scores are presented below for 7th and 8th grade students. Specifically, Table S26 shows the correlation table between 7th grade students' commonly reported technology uses, demographic variables, and May 2007 ELA MCAS performance.

Table S26: Correlation table between 7th grade students commonly reported technology uses, demographic variables, and May 2007 MCAS performance

	BWLI		Comparison	
	ELA	Math	ELA	Math
ELA raw score		**0.66**		0.65
Math raw score	**0.66**		**0.65**	
# of books at home	0.28	0.27	0.24	0.22
Free/reduced lunch	–0.28	–0.32	–0.33	–0.21
In the past year how often did you use technology in your classroom?	**0.10**	**0.10**	**–0.21**	–0.11
Student computer use in Reading/ELA	0.05	0.01	**–0.14**	**–0.12**
Student computer use in Social Studies	0.08	0.08	–0.03	–0.08
Student computer use in Math	0.01	0.07	–0.03	–0.02
Student computer use in Science	0.05	0.06	**–0.16**	**–0.17**
Teacher computer use in Reading/ELA	0.08	0.00	0.01	–0.01
Teacher computer use in Social Studies	**0.11**	0.08	0.07	0.00
Teacher computer use in Math	**0.13**	0.08	0.10	0.06
Teacher computer use in Science	0.08	0.03	0.03	–0.06
Send and receive email	0.05	0.01	–0.10	–0.05
Write first drafts	0.05	–0.01	0.01	–0.03
Edit papers using a computer	0.04	0.02	–0.08	–0.02
Create graphs or tables	–0.03	**–0.11**	–0.03	–0.02
Find information on the Internet	0.06	0.05	–0.05	–0.03
Create a Hyperstudio/PowerPoint presentation	**–0.14**	**–0.12**	–0.05	**–0.14**
Play computer games	–0.03	**–0.09**	–0.09	–0.07
Work with spreadsheets/databases	–0.06	**–0.10**	–0.02	–0.06
Solve problems	–0.07	–0.08	–0.11	–0.06
Analyze data	–0.05	–0.07	**–0.14**	–0.06
Take a test, quiz, or practice test	–0.08	–0.04	–0.12	**–0.14**
Take notes in class using a computer	–0.06	–0.03	–0.11	**–0.12**
Present information to the class	–0.05	–0.08	**–0.13**	–0.05
Keep track of dates and schedule/calendar using a computer	–0.04	–0.01	**–0.25**	**–0.21**

Bold correlations represent statistical significance at the .05 level (2 tail)

Table S26 shows the correlational relationship between 7th grade (regular education) students' 2007 performance on the ELA and Math sections of the MCAS with socioeconomic status indicators and commonly reported technology practices. Although there is a great deal of information presented in Table S26, overall it appears that there are few strong relationships between students' and teachers' technology uses measured by the Spring 2007 survey and student achievement as measured by the Spring 2007 MCAS. It is noteworthy that for both the comparison school sample and the BWLI sample, that the relationship between the ELA raw score and Math raw score exhibited a strong positive correlation (.65 and .66, respectively) indicating that students' performance on the ELA section of the MCAS is likely to be similar with their performance on the Math sections. In addition, both samples of students exhibited statistically significant relationships between indicators of students' socioeconomic status and MCAS performance. As expected from the literature, students who had fewer books in their home performed worse on the state test than those students with more books in their home. Similarly, the correlation between students' eligibility for free or reduced lunch was negatively correlated with MCAS performance indicating that low-SES students received lower test scores than students who were not eligible for assistance programs. Both of these results suggest that students' background environment plays a substantial role in their subsequent test performance. The relationship between student home variables and their test performance has a long history in educational research and testing, and the results presented here echo much of this literature.

In terms of the relationship between students' and teachers' reported use of technology and test performance, only weak and largely negligible results were found for the BWLI 7th grade students (who had less than one year of 1:1 use in school) as well as for the comparison school 7th grade students (who never participated in a 1:1 laptop program). Despite the lack of major substantive results, a few interesting patterns do emerge from the Year 2 7th grade data that may begin to reflect the overwhelmingly positive impacts BWLI teachers have shared about the impact of the 1:1 laptop program. For example, although the relationships are weak, every measure of students' subject specific technology use (ELA/Reading, Math, Social Studies, and Science), were positively correlated with ELA and Math MCAS results for BWLI respondents but were universally negative for the comparison group students. This same pattern emerges between students' reported "use of technology in the classroom" which exhibited a statistically significant (but still quite small) positive relationship (r = .1) with BWLI respondents' ELA and Math scores and a negative relationship for comparison school students. In other words, more frequent use of technology in the classroom (and for student use across primary subject classes) was associated with negligibly higher test scores on the ELA and Math sections of the MCAS for the BWLI 7th graders. Conversely, increased use of technology in the comparison settings was associated with negligibly lower test scores on the ELA and Math sections of the MCAS for the comparison school 7th graders.

Also presented in Table S26 is the relationship between the frequency of teachers' reported use of technology across the four primary classes (ELA/Reading, Math, Social Studies, and Science) as measured by the BWLI student survey and 2007 MCAS performance. Like the student use across the primary subject areas, the relationship between teachers' reported use and test performance was positive, but weak, for BWLI students with statistically significant correlations observed between

teachers' use of technology in Social Studies and Math class and the ELA raw score on the MCAS. No statistically significant results were observed between the comparison school teachers' use of technology in the primary subjects and 7th grade MCAS performance.

Lastly, Table S26 includes a summary of correlations between specific examples of common technology uses in schools and raw ELA and Math MCAS scores. As shown above, nearly all specific technology uses exhibited weak, negative correlations with the test results both for BWLI students and comparison school students. These results suggest that the specific skills gained by students who frequently use these technology applications in school may be unrelated or negatively related with MCAS performance.

Table S27 continues the Year 2 analyses of student and teacher technology use during the 2006–2007 school year and the Spring 2007 MCAS performance. Table S27 shows the correlational relationship between 8th grade students' 2007 performance on the ELA, Science, and Math sections of the MCAS with socioeconomic status indicators and commonly reported technology practices.

Table S27: Correlation table between 8th grade students commonly reported technology uses, demographic variables, and May 2007 MCAS performance

	BWLI			Comparison		
	ELA	**Science**	**Math**	**ELA**	**Science**	**Math**
ELA raw score		**0.64**	**0.68**		**0.62**	**0.59**
Science raw score	**0.64**		**0.73**	**0.62**		**0.72**
Math raw score	**0.68**	**0.73**		**0.59**	**0.72**	
# of books at home	**0.32**	**0.32**	**0.33**	**0.27**	**0.19**	**0.27**
Free/reduced lunch	**–0.23**	**–0.19**	**–0.26**	**–0.22**	**–0.23**	**–0.23**
In the past year how often did you use technology in your classroom?	**0.09**	**0.14**	**0.12**	–0.09	0.05	–0.05
Student computer use in Reading/ELA	0.03	–0.01	0.04	0.00	–0.02	–0.03
Student computer use in Social Studies	0.08	**0.11**	**0.15**	0.03	0.00	–0.01
Student computer use in Math	0.03	–0.03	0.03	**–0.11**	**–0.12**	**–0.15**
Student computer use in Science	**0.13**	**0.16**	**0.15**	**–0.11**	–0.03	**–0.10**
Teacher computer use in Reading/ELA	0.02	0.00	–0.05	–0.05	0.06	0.06
Teacher computer use in Social Studies	0.05	0.04	0.03	–0.06	0.09	0.10
Teacher computer use in Math	0.08	0.00	0.05	–0.06	0.10	0.07
Teacher computer use in Science	0.03	0.08	0.06	–0.04	**0.12**	0.07
Send and receive email	0.09	0.06	**0.11**	–0.02	–0.06	0.00
Write first drafts	0.07	0.05	0.06	0.02	–0.09	–0.10
Edit papers using a computer	0.04	0.04	0.09	**0.12**	–0.02	–0.08
Create graphs or tables	–0.05	0.00	0.03	–0.06	–0.11	–0.09
Find information on the Internet	–0.03	–0.04	–0.03	–0.02	–0.10	**–0.17**
Create a Hyperstudio/PowerPoint presentation	**–0.12**	–0.08	–0.09	–0.08	–0.07	**–0.12**
Play computer games	**–0.11**	0.01	–0.09	**–0.13**	–0.04	**–0.15**
Work with spreadsheets/databases	**–0.10**	–0.03	–0.06	0.00	–0.10	–0.04
Solve problems	**–0.13**	–0.09	**–0.11**	–0.06	–0.06	–0.07
Analyze data	–0.03	0.05	–0.01	–0.02	–0.09	–0.10
Take a test, quiz, or practice test	–0.05	0.01	0.02	0.00	–0.08	–0.09
Take notes in class using a computer	0.03	–0.01	0.03	–0.05	–0.06	–0.06
Present information to the class	–0.05	–0.04	0.01	–0.04	–0.09	–0.09
Keep track of dates and schedule/calendar using a computer	–0.02	0.02	–0.01	–0.07	–0.03	–0.04

Bold correlations represent statistical significance at the .05 level (2 tail)

Table S27 displays the correlational relationship between 8th grade (regular education) students 2007 performance on the ELA, Science, and Math sections of the MCAS with socioeconomic status indicators and commonly reported technology practices. Like the 7th grade results in Table S26, there is a great deal of information presented in Table S27, and overall it appears that there are few strong relationships between students and teachers technology uses measured by the Spring 2007 survey and student achievement as measured by the Spring 2007 MCAS. Correlations between the ELA, Science and Math sections of the test were strong and positive indicating that students who perform well on one section of the test, are likely to perform well on other portions. Like the prior results, both samples of students exhibited statistically significant relationships between indicators of students' socioeconomic status and MCAS performance. Again, as one would expect from the educational literature, students who had fewer books in their home performed worse on the MCAS than students with more books in their home. Similarly, the correlation between students' eligibility for free or reduced lunch was negatively correlated with MCAS performance, indicating that low-SES students received lower test scores than students who were not eligible for assistance programs. Both of these results again suggest that students' home background and environment plays a substantial role in their test performance.

In terms of the relationship between students' and teachers' reported use of technology and test performance, only weak and largely negligible results were found for the BWLI 8th grade students (who had about one and a half school years of 1:1 use) as well as for the comparison school 8th grade students (who never participated in a 1:1 laptop program). Similar to the 7th grade results, the 8th grade data provides few major findings, but a few interesting patterns do emerge from the data that again reflect some of the overwhelmingly positive impacts BWLI teachers have stated about the impact of the 1:1 laptop program. For example, although the relationships are generally weak, nearly all measures of students' subject specific technology use were positively correlated with MCAS results for BWLI respondents but were either less strong or negative for the comparison group students. In fact, BWLI students' use of technology in their science class exhibited a positive statistically significant relationship with ELA, Math, and Science test scores. Similarly, BWLI students' use of technology in their Social Studies class exhibited a positive statistically significant relationship with both Math, and Science test scores. A similar pattern emerges between students' reported "use of technology in the classroom" which exhibited a statistically significant (but still quite small) positive relationship with BWLI respondents ELA, Science, and Math scores and a weaker or negative relationship for comparison school students. Based upon these preliminary findings, more frequent use of technology in the classroom (and for student use across primary subject classes) was associated with negligibly higher test scores on the ELA, Science, and Math sections of the MCAS for the BWLI 7th graders.

Also presented in Table S27 is the relationship between the frequency of teachers' reported use of technology across four subjects (ELA/Reading, Math, Social Studies, and Science) as measured by the student survey and 2007 MCAS performance. The relationship between teachers' reported use and test performance was weaker for BWLI students than student use, although most correlations remained positive. However, no statistically significant results were observed between BWLI

or comparison school teachers' use of technology (in ELA/Reading, Math, Social Studies, and Science) and their 8th grade students' 2007 MCAS performance.

Lastly, Table S27 includes a summary of correlations between specific examples of common technology uses in schools and raw ELA, Science, and Math MCAS scores. As shown above, nearly all specific technology uses exhibited weak correlations with the 2007 MCAS results for both BWLI and comparison school students. Although some uses were determined to have a positive or negative statistically significant relationship, the vast majority of these individually measured technology applications appear unrelated or negatively related with MCAS performance.

Discussion

The data presented in the current paper provides some perspective on the early implementation of a 1:1 student computing initiative. In this report, students' and teachers' technology use is summarized across the first two years of the BWLI implementation. By comparing BWLI students' use of technology to past recorded levels and to students in a non-1:1 laptop setting, we can see how the laptop program may have affected teaching and learning practices across the five Berkshire schools. Although many of the overarching BWLI program outcomes go well beyond simply increasing the frequency of technology use, it is important to initially focus on measuring and documenting technology use, which provides the first indication that the program is having any impact. If technology use is highly limited or non-existent, there can be little to no educational benefit to the technology program. In other words, none of the overarching program goals or outcomes can be realized if the technology goes unused by teachers and students. The current document, as an interim report of a pilot program, provides some formative summary of the program effects to date and the results presented herein should be considered in this light.

The data presented in this report also represents the first look at teacher perception of the BWLI program and their thoughts on the effects of 1:1 computing upon their students. The current document also summarizes the relationship between various student technology uses and performance on a state assessment. As previously stated, the overall aim of the program is to determine the efficacy of a one-to-one laptop initiative in transforming teaching and learning in a middle school setting. Specifically, the targeted outcomes of the BWLI focus on: enhancing student achievement, improving student engagement, improving classroom management, enhancing students' capabilities to conduct independent research and collaborate with their peers, as well as creating fundamental paradigm changes in teaching strategies and curriculum delivery. The current data provide the first direct look at many of these outcomes.

Widespread Increases Reported for a Variety of Students Educational Technology Uses

Looking cumulatively across the Year 2 student survey results, it is clear the majority of BWLI students used technology for at least some portion of every day during the second year of the projects implementation. Year 2 survey results show more frequent technology use by the BWLI stu-

dents compared to levels reported in the two comparison schools as well as the pre-program levels at the BWLI schools. Although some technology use was reported to occur in the school library and in labs, the majority of BWLI students' technology use was reported to be occurring within the classrooms.

Despite a great deal of variability in the frequency of use across subject areas within most BWLI schools, students use of technology during the second year of the BWLI implementation was still substantially greater than pre-BWLI levels and student use at the comparison schools. Specifically, when compared to the students in the two matched comparison schools, BWLI students typically reported using technology three to four times more frequently during the 2006–2007 school year. Looking across the schools for subject area trends, we find that in three of the five BWLI schools, Math classes were the site of the least amount of technology use, while Social Studies was the site of the least frequent use in the other two BWLI schools. Similarly, no single subject area received universal high use at more than two schools, suggesting that factors within each school play a larger role in the adoption and student use of technology than factors related to individual subject areas.

By the end of the second year of the BWLI implementation there were many teachers who used technology on a nearly daily basis with their students while other teachers in the same building, grade level, and subject area would rarely have their students use technology. Looking across the schools for subject area trends, we find that in three of the five BWLI schools, Math classes were the site of the least frequent use, while Social Studies classes were the site of the least frequent use in the other two BWLI schools. Similarly, no single subject area received universal high use at more than two schools, suggesting that factors within each school play a larger role in the adoption and student use of technology than factors related to individual subject areas. Also, in the current data we see that 6th grade students generally reported less frequent use compared to grades 7 and 8 where students and teachers had longer access and greater experience in student 1:1 settings. Future data sets may allow for additional analyses of any shared characteristics for those teachers and classrooms who adopted and made widespread use of technology and those who chose to continue their pre-1:1 practices. Year 3 results will continue to explore how teaching practices have changed across the varied BWLI settings as the programs continues to mature and as students and teachers become increasingly familiar with technology in schools.

In addition, BWLI students reported using technology across a wide variety of applications and with substantially greater frequency than students in the comparison schools. However, there was again substantial variation in the frequency of technology use across the five BWLI schools. By far, the most frequently reported technology use was using a computer "to find information on the Internet". Other frequent uses of technology in the 1:1 settings included using a computer to: "access a teacher's web site", "play computer games", "take notes in class" and "edit papers using a computer". Some of the least frequent in-school technology uses during the 2006–2007 school year included using a computer "take a test, quiz, or practice test," "work with spreadsheets/databases," and "send and receive email".

Shifting Teacher Practices and the Role of the Teacher

Looking across the various surveyed technology uses, it appears that the majority of 1:1 teachers have made major changes in how they construct their lessons, communicate with other professionals, and present content to their students. Repeatedly, the teacher and student survey data show that the majority of students and teachers quickly assimilated this new technology into the curriculum. Although the results presented herein focus on the teacher and student surveys, many of the findings were triangulated by teacher interviews, administrative interviews, classroom observations, and the analysis of student drawings over time.

The teacher data also shows a major increase in the degree to which technology was used by BWLI students to complete their work and assignments in school. This increase in the integration of instructional technology throughout the teachers' workday was reflected by both the student and teacher findings.

Taken collectively, these results show that teacher practices have changed substantially since the first administration of the survey at the beginning of the program. In general, teachers have adopted and applied a wide variety of techniques to incorporate educational technology into their professional lives including the expectation that their students will actively use computers as a learning tool. Teacher survey results show substantial shifts in teaching and learning practices since the beginning of the BWLI program, although the differences between the partial implementation in Year 1 and the full implementation in Year 2 were not as robust as could be expected since all teachers across all grade levels were now in a 1:1 environment.

Further exploration of the survey data as well as classroom visits, teacher interviews, and principal interviews provides additional information about some of the relational effects of this multi-school technology initiative. Across all of the observed classrooms, the decision to use technology was nearly universally made by the classroom teacher. In other words, students themselves are not typically at liberty to use their laptops in school without being assigned to by their teacher. Thus, the role and attributes of the teachers should not be undervalued when considering the success of a program. As evidenced by both the student and teacher data, there was a wide distribution of teachers' technology use observed in each 1:1 school. Survey data, as well as the qualitative data collected in these 1:1 schools, suggest that teachers' adoption of technology is related to a number of factors. These factors include teachers' beliefs and attitudes about the value of student computers, teachers' comfort and skill using technology, ease of access to technology, quality and timeliness of technology support, professional development and training, as well as a school culture and leadership that values and promotes technology. An investigation into the various factors that impact how teachers use technology will be explored in subsequent reports using Year 3 survey data.

Variability of Technology Use

Despite the clear results showing an overall change in the teaching and learning practices across the BWLI schools as a result of the student laptop implementation, there remains a great deal of variation in the frequency of teachers' and students' technology use. Looking cumulatively across the Year 2 results we can see that the majority of BWLI students used technology for at least some

portion of every day during the 2006–2007 school year. However, it is entirely possible that a BWLI student could go through a day of classes without using their laptop if they were assigned to the (shrinking) minority of BWLI teachers who rarely use technology with their students.

Teacher Reflection

Looking across all of the teacher survey responses, there is very little negative sentiment concerning 1:1 computing or its impacts. In nearly all cases BWLI teachers typically responded either positively or neutrally when assessing the impacts of the program. Based upon the Year 2 survey data, the majority of BWLI teachers report that the program has resulted in:

- Improved quality of student work,
- Increased ability of students to work independently,
- Improved student engagement/interest level,
- Improved student motivation, and
- Improved student participation in class.

Thus, after even a limited deployment period participating teachers expressed many positive attributes emerging from the BWLI program. Looking across the survey results, teachers overwhelmingly reported improvements in their students work and behavior in the classroom. Based on the May 2007 survey results, BWLI teachers generally support many of the claims attributed to 1:1 laptop initiatives including improvements in student motivation, engagement, and participation. Moreover, a number of teachers reported that their participation has changed the way they think about and perform their teaching duties. This emerging result coincides with the expressions of many of the 1:1 principals who have found their schools participation in the 1:1 program an excellent vehicle for teacher reflection. Moreover, a large majority of BWLI teachers reported that their own computer skills had improved as a result of their participation in the program, which has led to changes in how they deliver their lessons and to a changing school climate as evidenced by both the student and teacher survey technology use results.

From the current analyses it is not yet clear if there are any specific teacher characteristics (for example: age, subject specialty, degree of technology use, etc.) that differentiate between those teachers who report that the program is having a positive impact and those teachers who do not. However, analyses of Year 3 teacher data will statistically explore such relationships and be reported in future evaluation documents.

In addition, the variation observed across the five participating schools will be further explored in subsequent reports as well as is individual reports provided to each school. In the preliminary exploration of teacher beliefs there did appear to be some emerging trends across schools. For example, the parochial teachers were generally the most positive. Conversely, the Pittsfield public school teachers appeared to be less impressed than the North Adams teachers with early effects of the BWLI program. These and other factors relating to teacher beliefs and attitudes will be further explored using Year 3 data and reported in future evaluation documents.

Limitations and Future Research

It is important to remember when viewing these results that the current analysis is not without its limitations. The response rates from the second year data collection were generally excellent allowing us to place more confidence in the assertion that the data presented herein adequately and properly represent the use and beliefs of the BWLI students and teaching staff. However, when considering these Year 2 results, it is also important to remember that nearly two-thirds of the responding students examined in May 2007 had been in a 1:1 setting for less than one year. Only the responding 8th grade class had any prior experience in a 1:1 setting prior to the 2006–2007 school year. Similarly, it is important to consider that for over half of the teacher respondents, the May 2007 teacher survey was completed after only one partial year of participation in 1:1 student computing. Only seventh grade teachers had more than a single year of experience when the survey was given in May/June 2007. As such, it is important to remember that many of the teacher survey respondents may be drawing on relatively little experience when addressing these issues. However, BWLI teachers are in the best position to observe the effects of the program and thus provide one of the best sources of information for investigating its impact. Thus, the current data still provides an excellent look into teachers' beliefs and experiences in a newly developed 1:1 setting.

Despite these caveats, the data collected during the first two years of the BWLI implementation provides in-depth information from the overwhelming majority of BWLI students and teachers in addition to responses from over 1,100 students in two comparison schools.

Every effort was made to present the data in a succinct yet transparent manner, while providing as much formative data as possible to BWLI and school leadership. The analyses presented in the paper represent only a fraction of the statistical iterations that were performed in exploratory analyses. It should be fairly clear based on the data presented in this paper that summarizing the student survey results is a complex task given that each of the three grade levels had different laptop implementation schedules. In addition, although each of the BWLI schools was provided similar resources through the BWLI program, each school had distinct characteristics in its technology resources, policies, support, and implementation. When considering these Year 2 results, it is also important to remember that nearly two-thirds of the responding students examined in May 2007 had been in a 1:1 setting for less than one year. Only the responding 8th grade class had any prior experience in a 1:1 setting prior to the 2006–2007 school year. Given these caveats, the data collected during the first two years of the BWLI implementation provides in-depth high quality information from the overwhelming majority of BWLI students in addition to responses from over 1,100 students in two comparison schools.

The relatively short window of time for teachers and students to transition into a 1:1 computing environment serves more to address the early stage of technology adoption and development than to address the sustained long-term effects of 1:1 computing on teaching and learning. These long-term effects, however, cannot be understood without the quantification of technology use such as documented in the preceding tables and figures. Again, before any of the proposed benefits of an educational technology can be explored, the research team must be able to document if technology use is actually occurring. While there is a strong desire to examine the impact of technology on stu-

dent achievement, research suggests that the impacts on learning must first be placed in the context of teacher and student technology use (Bebell, Russell, & O'Dwyer, 2004). In other words, before the outcomes of technology integration can be studied (a) there must be a clear understanding of how teachers and students are using technology in 1:1 environments, and (b) valid and reliable measures of these uses must be developed. Instead of developing measures of use, some research studies that examine the relationship between achievement and technology use assume that teachers' and students' access to technology is an indicator of technology use (for example see Angrist and Lavy, 2002).

Measuring the Relationship Between Emerging Technology Practices and Student Achievement

The current study presents the first examination of the relationship between BWLI students' and teachers' use of technology in school and student performance on a state test of academic achievement. It should be clearly stated that the current analysis does not directly examine changes in student achievement as a result from participation in the BWLI program. Only results from the May 2007 MCAS administration were examined in the context of their relationship with technology use. In other words, the current report does not report any changes in student learning since only one measure of student learning (the May 2007 MCAS) is examined. Correspondence and interview data from each of the BWLI schools show that 2007 MCAS averages (the same data examined in the current paper) had increased over past cohort averages. Although many within the schools attribute this improvement to the BWLI program, there are in fact a number of related and unrelated educational reforms underway at each school with the goal of boosting student achievement. So in addition to the arrival of student computing for all grades during the 2006–2007 school year, students also experienced a variety of other changes in teaching and learning practices that could be responsible for the improved test scores. In other words, the 2006–2007 test gains may be a direct result from students' participation in the BWLI program or could be resulting from the other related and unrelated educational reforms being applied at these schools. In future analyses, data from prior MCAS administrations will be merged with 2007 results and provide an indication of whether the test scores' gains of 2007 represented an actual increase in a students' test performance as they progressed through grades or if the gains were just reflected the different characteristics of student cohort taking the test.

The results of the MCAS analyses presented herein generally showed that there were no major relationships between specific uses of technology in school during the 2006–2007 school year and students' May 2007 test performance. However, both the 7th grade and 8th grade results suggest the real possibility that the positive impacts that BWLI teachers have stated about the impact of the 1:1 laptop program on learning could be realized in later assessments or with a more sensitive test. For example, although the relationships are generally weak, nearly all measures of students subject specific technology use were positively correlated with MCAS results for BWLI respondents but were either less strong or negative for the comparison group students. It is expected that the final analyses using three years of cumulative survey and assessment data (including a computer writing exercise) will be able to provide a more definitive and detailed examination of the complicated

relationship between students test performance and participation in the various components of the BWLI program.

It is fair to say the current results show a positive (and even statistically significant) relationship between some student uses of technology and the MCAS results, however the strength of the relationship was routinely small. Moreover, the practical significance of correlations less than .2 is largely negligible. These results do not necessarily mean there is no relationship between students' and teachers' use of technology and student achievement, particularly considering the severe limitations of the deployment period and measurement of student learning.

When examining the impact of 1:1 technology use on student learning, it is critical that the outcome measures actually assess the types of learning that may occur as a result of technology use and that those measures are sensitive enough to detect potential changes in learning that may occur. Since the MCAS aims to measure a domain broadly, the raw test score likely does not provide measures that are aligned with the learning that may occur when technology is used to develop specific skills or knowledge. As an example, computers may be used extensively in mathematics classes to develop students' understanding of graphing and spatial relationships, but not for other concepts. While the state mathematics test may contain some items related to graphing and spatial relationships, it is likely that these two concepts represent only a small portion of the assessment and are tested with a limited number of items, if any. As a result, the total test score is unlikely to be sensitive to any effects of computer use on these two concepts. While analyses could focus on the subset of items that focus on these concepts, the small number of items is likely to be insufficient to provide a reliable estimate of student achievement in these areas. Rather than employing state test results, an alternate strategy is to develop customized tests that contain a larger number of items specific to these concepts. Although it can be difficult to convince teachers and/or schools to administer an additional test, aligned assessments will result in more reliable scores and provide increased validity for inferences about the impacts of computer use on these concepts. To this end, students across all of the BWLI public schools will participate in computer writing assessment that assesses students' writing of MCAS-like essays using their BWLI computers versus using paper and pencil as currently required by the state.

Conclusion

These Year 2 results provide a clear picture that student and teaching practices changed dramatically in the vast majority of BWLI classrooms despite the short implementation period being considered. Although such robust increases in the use of technology may seem an expected outcome after an intensive computer implementation, it shows that within a very short period of time BWLI staff and students changed their existing teaching and learning practices. This finding should not be overlooked as it most clearly represents the willingness and effort of the BWLI staff to implement a new way of educating. Although there are significant differences across and within the individual schools, the student survey data shows that students were using laptops across the curriculum for a variety of educational aims in a relatively short period of time after the projects beginnings. Year 3 data will provide more substantive results on the characteristics and the variety of new teaching and learning practices that appears to be continually emerging from a large number of 1:1 classrooms.

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Appendix A

Gender and Grade Differences in Internet Aggression: Development of the eBehavior Scale

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Research on relational aggression has flourished during the past two decades and researchers widely acknowledge that behaviors such as gossiping, exclusion, and rumor spreading constitute aggressive behavior. The explosion of the internet and its wide array of communication tools are likely providing additional means for adolescents to engage in relational aggression than in years past, yet the empirical data to support this contention are scant. Ybarra and Mitchell (2004), using data from the national telephone survey of Finkelhor, Mitchell, and Wolak (2000), clearly identified that adolescents experience harassment on the internet, but their assessment of internet aggression consisted of only two generally worded items which failed to distinguish among different forms of aggression. The purpose of the present study was to develop a longer and more focused instrument to assess relational aggression in the on-line context and to examine grade and gender differences in Internet aggression among early adolescents.

One thousand seven hundred and eleven sixth, seventh, and eighth grade students (856 boys, 855 girls) from five (BWLI) middle schools in Massachusetts participated in the present study. At the end of the school year, students completed an on-line survey for a larger study which included items about their use of computers at home and the eBehavior Scale to measure internet aggression. The eBehavior Scale was modified from the Children's Online Behavior Scale (COBS; Sandstrom, Cart, Morgen, Mulligan, & Perry, 2006) which was found to correlate significantly with teacher reports of student aggression in a sample of middle school students. The eBehavior Scale consists of 10 items assessing both positive and negative social experiences that students could have in chat

rooms and/or on instant messengers (IM). Students were asked "On a typical day, how often do you use chat/instant messenger for the following…" with response options of 0 "never", 1 "a little", 2 "sometimes", 3 "often", and 4 "a lot". The scale was reliable with a Cronbach's alpha of .85.

Principal components factor analysis was used to determine the factor structure of the new instrument. The two factor structure accounted for 62.4% of the total variance. Five prosocial items clearly loaded on the first factor with five relational aggression items loading on the second factor (see Table 1 for factor loadings).

Although the mean responses on the internet relational aggression items were all below 1 ("a little"), 23.3% of students reported at least "sometimes" intentionally blocking someone, 18.4% at least "sometimes" showed a buddy's message to someone who wasn't supposed to see it, 16.3% at least "sometimes" made rude or nasty comments, and 13.7% at least "sometimes" said mean or hurtful things about someone to another buddy. These findings suggest that a substantial minority of students are consistently behaving aggressively on-line.

To further evaluate student responses on the eBehavior Scale, a 2 (gender) x 3 (grade) x 2 (IM type) ANOVA with repeated measures on the last factor was calculated. We found a main effect of grade, $F(2, 1705)=19.08$, $p<.001$, partial $\eta 2=.022$. Post-hoc analyses revealed that eighth graders engaged in significantly more instant messaging behavior ($M=1.52$) than seventh graders ($M=1.34$) and sixth graders ($M=1.23$). Main effects of gender and IM type were both qualified by a gender by IM type interaction, $F(1, 1705)=82.69$, $p<.001$, partial $\eta 2=.046$. As illustrated in Figure 1, prosocial use was clearly more frequent than aggressive and girls engaged in more instant messenger use overall, but the difference was more pronounced for prosocial than aggressive use. These findings are consistent with previous research suggesting that boys are using computers for social interactions more than previously thought (Gross, 2004).

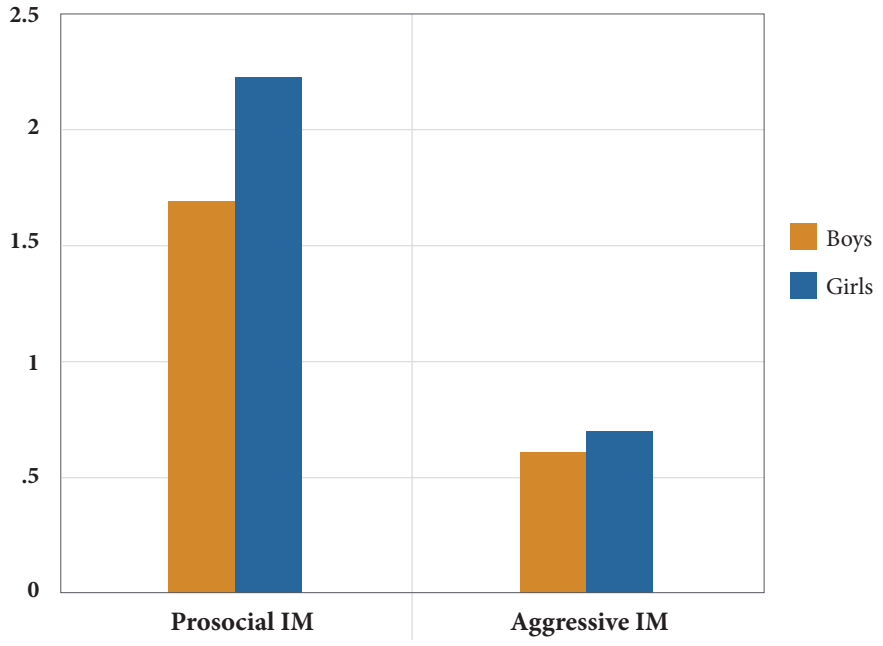
Finally, we correlated the two eBehavior subscales with items assessing various aspects of students' computer use at home. Students were likely to behave more prosocially on-line when there were more computers in their home, $r(1716)=.11$, $p<.001$, with increased feelings of competence on a computer, $r(1709)=.13$, $p<.001$, and when they spent more time on the computer at home, $r(1697)=.26$, $p<.001$. The latter relationship was also found for internet aggression as the more time students spent on the computer at home, the more likely they were to behave aggressively on-line, $r(1694)=.17$, $p<.001$.

While it is encouraging that adolescents self-report significantly more prosocial than aggressive behavior using chat rooms and IM, these results still suggest cause for concern about internet aggression and directions for future research. For example, it is possible that the participants underreported their aggressive on-line behavior, a point that should be explored in future research by the inclusion of other measures of aggression, such as peer and teacher reports. It is also important to consider the associations between internet aggression and psychosocial adjustment and it is our contention that the eBehavior Scale demonstrates strong psychometric properties to facilitate these future research endeavors.

Table A1: Factor loadings for the eBehavior Scale items

Item	Factor 1	Factor 2
Have a really good conversation	**.868**	.122
Have fun with my friends	**.850**	.119
Make social plans	**.783**	.231
Give and/or receive helpful advice	**.738**	.170
Give and/or receive help with homework	**.619**	.131
Say mean or hurtful things about someone to another buddy	.062	**.828**
Make rude or nasty comments	.113	**.817**
Show a buddy's message to someone who wasn't supposed to see it	.148	**.757**
Intentionally block someone because you don't like them	.198	**.741**
Intentionally block someone because you are mad at them	.301	**.671**

Figure A1: Gender by IM type interaction for the eBehavior Scale



Endnotes

1 A more detailed and thorough discussion of the methodological challenges (and solutions) was presented at the Annual Meeting of the American Educational Research Association (AERA) in Chicago (April, 2007) and is available at www.intasc.org

2 It should be noted that the summary statistics presented in Tables S17–S20 only represent those students who reported access to at least one computer at home. The five percent of survey respondents who reported that they did not have a home computer were not presented any additional survey items regarding home computer access and use.