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# Berkshire Wireless Learning Initiative Final Evaluation Report

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## Results

Given the wide variety of data sources employed in the current study, results from each mode of inquiry are presented individually. First, results from the teacher survey are summarized. Next, results from the principal/school leader interviews, classroom observations, and student drawings summarized. Finally, student survey results are detailed before an examination of the results from the analyses of student achievement. Following the individual results section, a collection of the principle BWLI program findings are summarized before the *Discussion* section.

### Teacher Survey Results: Adoption and Use of Technology

In the next series of figures and tables, teachers' use of technology is explored across BWLI schools and compared to a sample of comparison non-1:1 teachers. Additionally, survey data is presented across four different teacher survey administrations, which have collected and summarized teacher practices and attitudes since the beginning of the first phase of 1:1 student computing in January 2006. Given teachers direct experience as both a 'participant of' and potential recipient of any positive outcomes resulting from the initiative, we strongly feel that the data collected across the teacher survey is worthy of the considerable attention and space we devote to it here. In addition, the exemplary response rates during the final rounds of teacher surveying insures that the data presented is a nearly direct representation of the entire populations of participating teachers. The summary of teachers' reported technology use data begins with Table T1, on the next page, which illustrates the frequency of teachers' use of technology during the 2008–2009 school year.

**Table T1: Frequency of teachers' use of technology during the 2007–2008 school year (June 2008)**

	Comparison Schools	BWLI Schools	Mean Difference
Create and/or maintain web pages	6.2	57.0	50.8*
Use a computer to deliver instruction to your class	28.7	57.3	28.6*
Use a computer to help students better understand a concept	19.6	46.3	26.7*
Use a computer to present information to your class	22.6	47.4	24.8*
Perform research and lesson planning using the Internet	61.2	85.6	24.4*
Assess students using a computer (including a test, quiz, or practice test)	22.0	40.5	18.5
Use a computer to model relationships and/or functions	6.4	20.8	14.3
Create WebQuests or build the Internet into a lesson	6.2	19.9	13.7
Adapt an activity to students' individual needs using computers	27.3	31.2	3.9
Use a computer to communicate with teachers, parents, or administrators	121.1	120.9	-0.2
Create a test, quiz, or assignment using a computer	64.4	60.3	-4.0
Prepare or maintain IEPs using a computer	21.2	15.8	-5.3
Make handouts for students using a computer	83.7	69.6	-14.2

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

Table T1 shows the comparison of BWLI teachers' frequency of technology use to that of comparison school teachers measured in the June 2008 survey administration. Overall, the average BWLI teacher used technology frequently for a wide variety of professional applications during the 2007–2008 school year, the third year of the BLWI implementation. Table T1 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 120 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 85.6 times across the 2007–2008 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” all of which occurred on more than 50 school days in Year 3 of the program.

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 than the comparison teachers. The largest difference was found for “creating and/or maintaining web pages” which had occurred almost third school day (57.0 times per

year) across the BWLI teachers and only 6.2 times per year for the comparison school teachers. Other statistically significant differences where BWLI teachers had used technology more frequently than the comparison school teachers during the 2007–2008 school year included: “delivering instruction”, “helping students better understand a concept”, “presenting information to your class”, and “performing research and lesson planning using the Internet”. 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 June 2008 survey. “Using a computer to communicate with teachers, parents, or administrators”, “creating a test, quiz, or assignment”, “preparing or maintaining IEPs” 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, these differences were not found to be statistically significant. Table T2 continues the exploration of the teacher technology use during the 2007–2008 school year by displaying the average frequency of a number of technology applications for teachers across the BWLI and comparison schools.

**Table T2: Frequency of teachers’ use of technology during the 2007–2008 school year by school (June 2008)**

	North	South	Conte	Herberg	Reid	St. Mark
Use a computer to deliver instruction to your class	23.2	33.0	65.4	56.3	50.5	83.3
Prepare or maintain IEPs using a computer	24.2	18.6	15.9	13.9	19.0	0.0
Adapt an activity to students’ individual needs using computers	34.7	21.5	33.6	34.2	27.6	14.3
Make handouts for students using a computer	85.0	82.8	83.0	62.1	64.0	114.3
Create a test, quiz, or assignment using a computer	65.0	63.9	68.4	53.0	63.0	44.8
Perform research and lesson planning using the Internet	63.3	59.5	85.4	81.3	88.8	103.8
Create WebQuests or build the Internet into a lesson	6.1	6.2	20.5	15.7	24.2	14.0
Use a computer to present information to your class	16.8	27.3	56.7	45.5	43.4	35.5
Use a computer to help students better understand a concept	16.2	22.3	55.0	56.2	30.5	36.0
Use a computer to model relationships and/or functions	4.0	8.3	28.6	22.7	13.0	21.5
Create and/or maintain web pages	12.7	0.7	79.8	54.4	40.1	97.5
Assess students using a computer (including a test, quiz, or practice test)	34.7	11.2	34.8	40.0	46.1	28.3
Use a computer to communicate with teachers, parents, or administrators	106.2	132.7	121.3	122.5	127.2	7.3

Looking across the BWLI schools in Table T2, patterns emerge showing which schools' teachers were using technology for what purposes during the third year of the BWLI implementation. For some technology applications, there was fairly 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 between 36 and 56 times for all BWLI schools compared to 16.8 and 27.3 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 30.5 and 56.2 times per year across the BWLI schools while this activity occurred less frequently in the comparison schools (16.2 and 22.3 times). 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 communicate with teachers, parents, or administrators" which was reported to occur 127 times per year by Reid teachers but less than 10 times per year by the St. Mark teachers. St. Mark teachers reported the most frequent "use of a computer to deliver instruction to your class" which happened 83.3 times during the 2007-2008 school year compared to about 50 times a year in the Pittsfield public schools and 65 times at Conte. Teachers' frequency of "creating and/or maintaining web pages" was greatest for the Conte and St. Mark teachers who performed this activity 79.8 and 97.5 times respectively during the 2007-2008 school year compared to 54 times at the Herberg school and 40 times at the Reid school.

Table T1 (presented on page 37) shows that BWLI teachers typically used technology more frequently across a wide variety of reporting categories than teachers from the comparison school. Table T2, above, shows that there was often substantial variation in teachers' technology use across the BWLI schools. Thus, after three years of the teacher laptop implementation and the BWLI program 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. Table T3 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, May 2007, and June 2008 survey administrations.

**Table T3: BWLI Teachers' use of technology over time**

	Jan. 2006	May 2006	May 2007	June 2008
Use a computer to deliver instruction to your class	22.7	58.8	59.2	57.3
Prepare or maintain IEPs using a computer	17.0	9.0	18.4	15.8
Adapt an activity to students' individual needs using computers	13.2	32.2	28.2	31.2
Make handouts for students using a computer	51.6	50.8	60.7	69.6
Create a test, quiz, or assignment using a computer	49.0	46.8	56.0	60.3
Perform research and lesson planning using the Internet	56.9	73.9	80.6	85.6
Create WebQuests or build the Internet into a lesson	8.8	20.3	21.9	19.9
Use a computer to present information to your class	23.9	56.7	47.4	47.4
Use a computer to help students better understand a concept	23.6	50.2	45.2	46.3
Use a computer to model relationships and/or functions	13.0	29.4	19.3	20.8
Create and/or maintain web pages	26.5	na	78.6	57.0
Assess students using a computer (including a test, quiz, or practice test)	24.1	na	43.6	40.5
Use a computer to communicate with teachers, parents, or administrators	89.6	105.4	111.2	120.9

Table T3 shows BWLI teachers' reported use of educational technology over four 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 times 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 times 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", and "model relationships and/or functions".

Thus, over 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 January 2006 results. Previous research has shown the important role of the teacher in determining how and when students will use their laptops while in school. Comparing the June 2008 teacher technology use results with the May 2007 results show that teachers' practices changed relatively little between the second and third year of the BWLI implementation. Across nearly most of the surveyed technology uses, BWLI teachers were consistent in their adoption and use of most technology applications in their work across the last two years of the laptop program. In the third year of the program BWLI teachers reported on average that they spent slightly less time using a computer to create and maintain web pages than in past surveys. However, professional uses of technology to support teaching continued increasing somewhat throughout the third year of the BWLI program with average reported increases reported for "using a computer to communicate with teachers, parent and administrators" (120.9 times), "make handouts for students" (69.6 times), "create a quiz, test or assignment using a computer" (60.3 times), and "perform research and lesson planning using the Internet" (85.6 times).

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 and comparison school teachers assigned their students to create products using technology during the 2007-2008 survey administration.

**Table T4: Comparison of BWLI and comparison teacher frequency of assigning students to create products using technology during the 2007–2008 school year (June 2008)**

	Comparison Schools	BWLI Schools	Mean Difference
Prepare for a standardized test or take practice tests	12.4	22.5	10.0*
Multimedia projects with technology	3.5	11.6	8.2*
Web pages, web sites, or other web-based publications	2.8	9.3	6.5*
Pictures or artwork with technology	8.4	14.1	5.7
Stories or books with technology	6.3	11.4	5.1
Reports and term papers with technology	7.5	11.1	3.6*
Graphs or charts with technology	5.3	7.1	1.8
Videos or movies	3.0	4.0	1.0
<b>Total</b>	<b>49.1</b>	<b>90.9</b>	<b>41.8*</b>

Note: \* denote statistically significant differences (Unequal variances;  $p < .01$ )

Table T4 displays a comparison of the frequency which BWLI and comparison teachers assigned their students to create products using technology during the 2007–2008 school year. In the June 2008 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. On average, BWLI teachers more regularly required their students to create products using technology during the 2007–2008 school year, the third year of the BLWI implementation. Table T4 shows that for the 180 potential days in the 2007–2008 academic year, BWLI teachers reported having their students use technology to create a product on 90.9 occasions, compared to 49.1 times in the comparison schools. The most frequent products assigned by BWLI teachers for their students to complete using technology were “prepare for a standardized test or take practice tests” (22.5 times per year), and “pictures or artwork” (14.1 times per year).

Comparing the averages of the BWLI teachers with comparison teachers across each of the different student uses revealed four statistically significant differences: “prepare for a standardized test or take practice tests,” “multimedia projects with technology,” “web pages, web sites, or other web-based publications” and “reports and term papers” although BWLI teachers more frequently required their students to create products using technology across all surveyed categories. Table T5 continues the exploration of the teacher technology use during the 2007–2008 school year by displaying BWLI and comparison teachers’ frequency of assigning students to create products using technology across the BWLI and comparison schools.

**Table T5: Frequency of teachers’ assignments of technology based student products during the 2007–2008 school year by school (June 2008)**

	North	South	Conte	Herberg	Reid	St. Mark
Reports and term papers with technology	9.5	5.9	9.8	12.7	10.5	8.0
Multimedia projects with technology	5.1	2.2	19.2	13.3	4.4	11.8
Web pages, web sites, or other web-based publications	3.7	2.1	6.2	9.7	11.2	9.0
Pictures or artwork with technology	9.6	7.3	11.7	14.0	16.1	12.0
Stories or books with technology	6.9	5.8	13.3	11.7	10.1	4.5
Graphs or charts with technology	4.4	6.0	7.0	8.2	5.6	11.5
Videos or movies	1.2	4.5	6.8	3.4	2.4	3.5
Prepare for a standardized test or take practice tests	7.8	16.2	28.2	22.3	19.8	2.8
<b>Total</b>	<b>48.1</b>	<b>50.0</b>	102.2	95.2	80.1	63.0

Based upon the June 2008 survey results shown in Table T5, patterns of different technology are evident across the different BWLI schools. Overall, when the variety of student products are summed, Conte and Herberg teachers report the most frequent use of technology by students to create products while Reid and St. Mark report the least frequent use of the BWLI schools. Teachers across both comparison schools (North and South) reported less frequent creation of student products using technology than any BWLI school.

Looking across the individual student products, a number of interesting use patterns emerge. Overall, the widest variation of technology enabled student products was observed for the use of a computer to “prepare for a standardized test or take practice tests” which Conte teachers reported as one of the most frequent student uses listed (28.2 times per year) while St. Mark teachers reported this as their least frequent technology use (2.8 times per year). For another example, Herberg teachers reported greater 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 “multimedia projects with technology” 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 “videos or movies” and “multimedia projects.” 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 schools. Table T6 continues the exploration of BWLI students’ use of technology to create products since the beginning of the BWLI program with a summary of such use averaged from the January 2006, May 2006, May 2007, and June 2008 survey administrations.

**Table T6: Frequency of teachers’ assignments of technology based student products over time**

	Jan. 2006	May 2006	May 2007	June 2008
Reports and term papers with technology	2.9	12.2	16.1	11.1
Multimedia projects with technology	2.7	11.5	11.0	11.6
Web pages, web sites, or other web-based publications	2.0	13.1	10.8	9.3
Pictures or artwork with technology	4.2	6.7	14.2	14.1
Stories or books with technology	0.4	4.7	9.7	11.4
Graphs or charts with technology	5.5	7.3	10.8	7.1
<b>Total</b>	<b>17.7</b>	<b>55.6</b>	<b>72.6</b>	<b>64.6</b>

Looking across all types of surveyed products in Table T6, we see that there has been a substantial and largely steady increase in the total frequency with which BWLI teachers assign their students to complete projects and create products using technology between January 2006 and May 2007, when most uses stabilized or decreased slightly for the third and final year of the initiative.

For example, in the January 2006 survey, BWLI teachers reported having their students create products using technology on 17.7 occasions. Six months later, including 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 days over the 2006–2007 school year, a four-fold increase over the original January 2006 estimates. During the 2007–2008 school year, the general frequency of use decreased slightly in the BWLI schools (64.6 occasions) although remained well above 2005–2006 and 2006–2007 levels. Based upon these findings, it is clear that, on average, BWLI teachers had their students use technology with regular frequency in school for a wide variety of purposes throughout the laptop initiative.

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 before leveling off to 11 times per year in June 2008. Between the 2006 and 2008 surveys, all measured uses of technology for student products increased including the creation of “pictures or artwork”, “stories or books”, and “graphs or charts” using technology. However, when looking across the three surveys when students had laptops (May 2006 through June 2008), BWLI teachers generally reported that use of technology had been fairly consistent with only small relative changes from year to year.

In general, the second year of implementation saw the highest frequency of uses while Year 3 use (as evidenced by the June 2008 survey) saw a decrease to 64.6 occasions for student products using technology. For example, students’ use of technology to create “graphs or charts” and “web pages, web sites, or other web-based publications” has decreased slightly in the second and third year of the program (May 2007 and June 2008) compared to the May 2006 teacher survey results. Such decreases, however small, are 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.

## **Teacher Survey Results: BWLI Teacher Reflections Towards 1:1 Computing**

In addition to the frequency and variety of technology use throughout the BWLI years, teachers were additionally asked in the survey to reflect on their experiences and perceptions of 1:1 computing in improving teaching practices and their students learning. In a series of 5-point Likert scaled survey questions (Strongly Agree, Agree, Neither Agree/Disagree, Disagree, and Strongly Disagree) teacher attitudes and beliefs towards 1:1 computing and the BWLI program were addressed after three years of the initiative in the June 2008 survey. Specifically, these survey questions asked teachers to consider the broader impacts of the program and to provide their opinion on various aspects of the 1:1 initiative. Table T7 begins the summary of teacher attitudes towards 1:1 computing by addressing the degree to which teachers feel the laptop program has impacted their students.

**Table T7: BWLI teachers' response to the statement "My students have benefited greatly from their participation in the 1:1 laptop program" (June 2008)**

	Conte	Herberg	Reid	St. Mark	Total
Strongly Disagree	0%	2%	2%	0%	1%
Disagree	0%	2%	5%	0%	3%
Neither Agree/Disagree	20%	24%	32%	0%	25%
Agree	27%	44%	37%	25%	37%
Strongly Agree	54%	29%	24%	75%	34%

Table T7 shows the frequency of teacher responses summarized across each of the BWLI schools for the statement: "My students have benefited greatly from their participation in the 1:1 laptop program". Overall, the majority of BWLI teachers (71%) reported either agreement or strong agreement suggesting teacher sentiment was largely positive in their assessment of the 1:1 programs positive impact on their middle school students. In other words, 71% of BWLI teachers felt that their students had "benefited greatly" from their participation in the BWLI program. In contrast, only a very small portion of teacher (4% total) disagreed with the statement that students had greatly benefited from their participation in the 1:1 laptop program.

Looking across the BWLI schools, the small degree of negative teacher sentiment was greatest in the Pittsfield public schools where 4% of Herberg staff and 7% of Reid staff "disagreed or "strongly disagreed". More commonly teachers who did not express positive sentiment expressed an impartial sentiment selecting "neither agree/disagree" from the survey response choices and comprising 25% of all respondents. Table T8, below, further explores teachers' attitudes towards 1:1 laptop program using June 2008 survey results.

**Table T8: BWLI teachers' response to the statement "My teaching has improved as a result of the 1:1 laptop program" (June 2008)**

	Conte	Herberg	Reid	St. Mark	Total
Strongly Disagree	2%	2%	5%	0%	3%
Disagree	2%	3%	10%	0%	6%
Neither Agree/Disagree	20%	35%	33%	25%	30%
Agree	34%	31%	28%	0%	30%
Strongly Agree	42%	29%	24%	75%	32%

Table T8 shows the frequency of teacher responses summarized across each of the BWLI schools for the statement: “My teaching has improved as a result of the 1:1 laptop program”. Overall, the majority of BWLI teachers (62%) reported either agreement or strong agreement suggesting teacher sentiment was largely positive in their assessment of the 1:1 programs positive impact on their own teaching. Put another way, 62% of BWLI teachers felt that their teaching had “improved as a result of the 1:1 program”. Conversely, a small portion of teachers (9% total) disagreed or strongly disagreed with their teaching had improved from the BWLI. Looking across the BWLI schools, the negative teacher sentiment was concentrated at the Reid school where 15% of staff did not agree that the program improved their teaching. However, only a small percentage of teachers (under 5%) at the other participating public schools shared the lack of belief that BWLI improved their teaching. More commonly, teachers who did not express positive sentiment expressed an impartial sentiment selecting “neither agree/disagree” from the survey response choices comprising 30% of all respondents. Table T9, below, further explores teachers’ attitudes towards 1:1 laptop program using June 2008 survey results.

**Table T9: BWLI teachers’ response to the statement “The impacts of any 1:1 computing program may take many years to be fully understood” (June 2008)**

	Conte	Herberg	Reid	St. Mark	Total
Strongly Disagree	5%	5%	3%	0%	4%
Disagree	10%	9%	9%	25%	9%
Neither Agree/Disagree	21%	20%	32%	25%	25%
Agree	49%	49%	41%	50%	46%
Strongly Agree	15%	17%	15%	0%	16%

Throughout the educational technology literature, there is frequent notation of the extended timeframe needed for technology initiatives such as the BWLI to impact teaching and learning. Earlier BWLI surveys demonstrated that many teacher and students behaviors changed within months of the laptop implementation in many settings, however many of the larger impacts expected from 1:1 initiatives may take substantially longer to realize. Table T9 presents the results of asking BWLI teachers to consider this issue based upon their own experiences. As such, Table T9 presents the frequency of teacher responses summarized across each of the BWLI schools for the statement: “The impacts of any 1:1 computing program may take many years to be fully understood.”

Overall, Table T9 shows that the majority of BWLI teachers (62%) reported either agreement or strong agreement suggesting teachers typically agreed that the impacts of a 1:1 computing program may take many years to be fully understood. Approximately 15% of all BWLI teachers disagreed or strongly disagreed with the statement while 25% of teachers provided a neutral response. Table T10, below, further explores teachers’ attitudes towards 1:1 laptop program using June 2008 survey

results, specifically how additional support may have improved the effectiveness program.

**Table T10: BWLI teacher attitudes towards increased curricular and technical support for improving the effectiveness of the BWLI program (June 2008)**

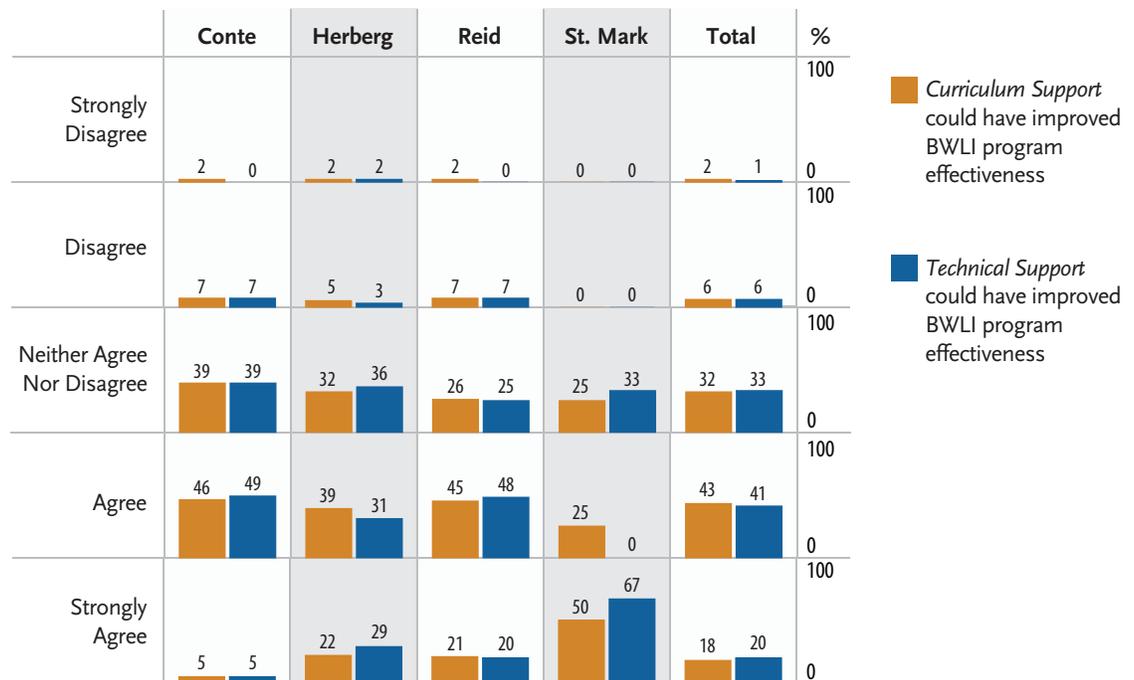


Table T10 presents the results of asking BWLI teachers to respond on a 5-point scale the degree to which “increased curriculum support and increased technical support could have improved the effectiveness of the BWLI program” across the four BWLI schools. Overall, just over half of BWLI teachers agreed or strongly agreed that both increased curriculum support and technical support could have improved the program. Approximately one third of responding BWLI teachers neither agreed nor disagreed that increased curriculum support or technical support would have improved the BWLI program. Looking across the schools, Conte teachers reported the least amount of overall agreement potentially indicating a higher level of satisfaction with the support they received while St. Mark teachers reported the highest amount of agreement suggesting their teachers felt additional support could have improved the impacts of the laptop initiative.

In general, teachers generally responded quite similarly in evaluating the potential benefits of increased curriculum and technical support. These results suggest that overall BWLI teachers generally did not feel that either the technical or curricular support had a disproportional negative impact on the effects of the program. Additional teacher sentiment towards 1:1 computing is further explored in Table T12 (next page), where BWLI teachers responded to a statement concerning the promotion of 1:1 computing programs in other Massachusetts middle schools.

**Table T11: BWLI teachers' response to the statement "I would encourage other Massachusetts middle schools to adopt 1:1 computing programs" (June 2008)**

	Conte	Herberg	Reid	St. Mark	Total
Strongly Disagree	2%	3%	5%	0%	4%
Disagree	0%	7%	15%	0%	8%
Neither Agree/Disagree	12%	20%	27%	25%	21%
Agree	45%	42%	29%	0%	37%
Strongly Agree	41%	27%	24%	75%	31%

Overall, after three years of participation in the BWLI program, the majority of BWLI teachers expressed positive sentiments towards 1:1 computing with 68% of teachers reporting "strongly agree" or "agree." About one in five teachers (21%) neither agreed nor disagreed that other Massachusetts middle schools should adopt 1:1 programs while the remaining 12% of BWLI teachers expressed disagreement with encouraging any future Massachusetts middle school laptop programs. Again, the highest concentration of positive teacher sentiment was observed at the Conte school (86%) and at St. Marks (75%) while negative teacher sentiment was concentrated in the Pittsfield public schools (particularly Reid). Table T12 continues the exploration of BWLI teachers' beliefs and sentiments towards the future 1:1 programs based upon their own BWLI experiences. Specifically, Table T12 asks teachers to consider if "the considerable costs and expenses associated with 1:1 laptop programs are not justified based on my experiences".

**Table T12: BWLI teachers' response to the statement: "The considerable costs and expenses associated with 1:1 laptop programs are not justified based on my experiences" (June 2008)**

	Conte	Herberg	Reid	St. Mark	Total
Strongly Disagree	34%	22%	22%	25%	25%
Disagree	32%	34%	12%	25%	25%
Neither Agree/Disagree	27%	24%	29%	50%	27%
Agree	5%	15%	29%	0%	17%
Strongly Agree	2%	5%	9%	0%	6%

Table T12 presents the results of asking BWLI teachers to respond on a 5-point scale the degree to which they agree that: "the considerable costs and expenses associated with 1:1 laptop programs are not justified based on my experiences" across the four schools. For this question, half (50%) of all BWLI teachers reported that they disagreed or strongly disagreed with the surveyed statement indicating that the considerable costs and expenses associated with a 1:1 laptop program is indeed justified based on their own experiences. Amongst the remaining half of teacher who did not expressly feel the expenses were justified, 23% noted that agreed the costs and expenses were not justifiable while 27% reported that they could neither agree or disagree with the statement. Thus, half of BWLI teachers found the cost and expenses justified while about one quarter of teachers did not and the remaining one quarter were not yet sure or neutral at the time of the survey (June 2008). Again, looking across the schools, different patterns of agreement are evident with teachers from Conte (7% agreement) and St. Mark (0% agreement) expressing the strongest support of laptop programs while Reid teachers expressed the least (38% agreement).

In addition to these queries above, in the Year 2 and 3 surveys teachers were also asked to reflect more directly on how their experiences with 1:1 computing had impacted their own teaching practices. Specifically, questions were included to determine if and how the BWLI program was impacting the way teachers conduct their classes and how students of different ability levels are adjusting and learning with the new technology. Teachers were presented with twelve Likert response items (Strongly Agree, Agree, Neutral, Disagree, Strongly Disagree) in the survey that addressed specific changes in their beliefs, practices, and abilities since the adoption of the 1:1 program. Figure T1, next page, presents these results across the five BWLI schools focusing specifically on teacher beliefs and experiences having taught in a 1:1 laptop setting.

**Figure T1: Frequencies of Year 3 BWLI teacher beliefs (surveyed June 2008)**

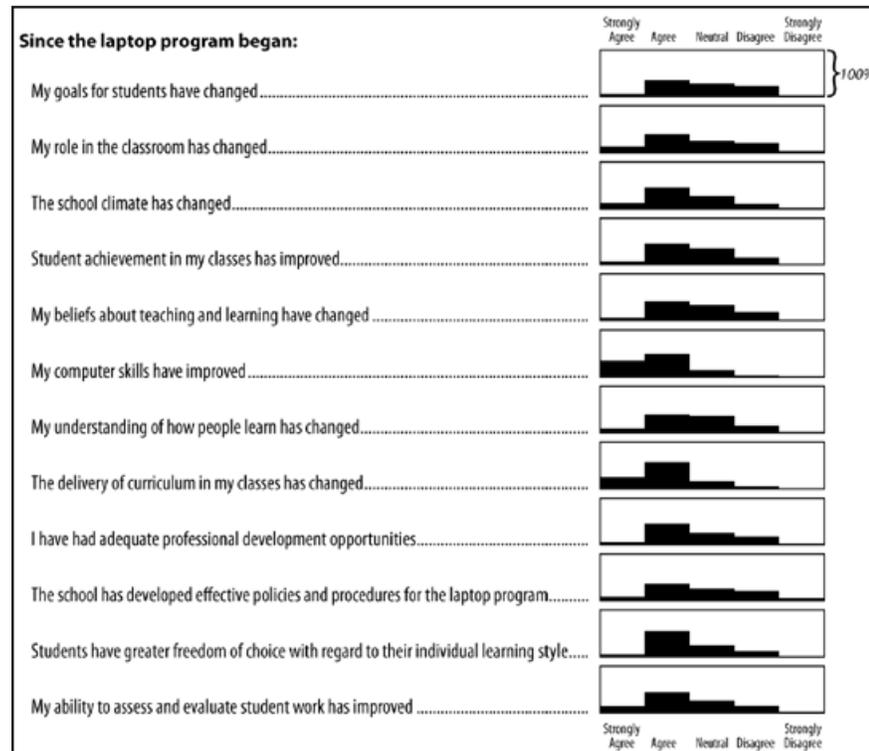


Figure T1 shows teachers' average responses ranked from most agreement to least agreement (top to bottom). As Figure T1 illustrates, participating teachers were generally quite positive toward their experiences and beliefs regarding the impacts of the BWLI program and 1:1 computing. Nearly all of responding teachers (83%) "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, just under 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 primary subject 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 15% "disagreed" or "strongly disagreed" while 35% responded "neutral"). Many teachers reported that they felt the new technology was a benefit for students with over 50% of respondents specifically reporting that they felt student achievement had improved (approximately 14% "disagreed" while 32% 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 more mixed sentiments concerning some implementation aspects of the BWLI program

with 47% of teachers stating that their “school had developed effective policies and procedures for the laptop program” while approximately 26% “disagreed” or “strongly disagreed” and 28% of teachers responded “neutral”. Also demonstrating a wide range of teacher sentiment, about 52% of teachers “agreed” or “strongly agreed” with the statement that they had been provided with “adequate professional development opportunities” while about 22% 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 participating in the study (6th, 7th and 8th). Table T13, below, shows the mean responses of Year 2 BWLI teacher beliefs across grade level.

**Table T13: Mean BWLI teacher beliefs across grade levels (June 2008)**

	6 <sup>th</sup> Grade	7 <sup>th</sup> Grade	8 <sup>th</sup> Grade
My computer skills have improved	4.2	4.2	4.0
The delivery of curriculum in my classes has changed	4.0	4.1	3.9
The school climate has changed	3.7	3.7	3.4
Students have greater freedom of choice with regard to their individual learning style	3.7	3.7	3.5
My ability to assess and evaluate student work has improved	3.6	3.7	3.4
Student achievement in my classes has improved	3.6	3.6	3.4
The school has developed effective policies and procedures for the laptop program	3.5	3.5	3.1
My understanding of how people learn has changed	3.5	3.5	3.3
I have had adequate professional development opportunities	3.4	3.4	3.4
My beliefs about teaching and learning have changed	3.4	3.4	3.2
My role in the classroom has changed	3.3	3.5	3.3
My goals for students have changed	3.3	3.3	3.2

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

As Table T13 illustrates, there was relatively little variation observed in teacher attitudes and beliefs across the different grade levels. Despite the variations in student and teacher use of technology across the participating grade levels, it is not very surprising to see the lack of variation in teacher attitudes across grade levels, as the program was similarly implemented in each grade.

### ***Teacher Perceptions Across Schools***

As prior analyses and research have shown differences in teacher practices across the BWLI schools, we also explored teacher attitudes across each of the BWLI schools in Table T14, below.

**Table T14: Mean BWLI teacher beliefs across participating schools (June 2008)**

	Conte	Herberg	Reid	St. Mark
My computer skills have improved	4.3	4.2	3.9	4.8
The delivery of curriculum in my classes has changed	4.0	4.0	3.9	4.5
The school climate has changed	3.9	3.4	3.7	4.0
The school has developed effective policies and procedures for the laptop program	3.9	3.1	2.8	4.3
Students have greater freedom of choice with regard to their individual learning style	3.9	3.6	3.3	4.3
My ability to assess and evaluate student work has improved	3.8	3.6	3.2	4.3
Student achievement in my classes has improved	3.8	3.5	3.2	4.3
My role in the classroom has changed	3.8	3.2	3.2	4.8
My understanding of how people learn has changed	3.7	3.3	3.3	4.3
My goals for students have changed	3.7	3.1	3.0	4.0
I have had adequate professional development opportunities	3.7	3.4	3.0	3.0
My beliefs about teaching and learning have changed	3.6	3.2	3.1	4.3

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

As illustrated by Table T14, there was somewhat more variation in teachers' beliefs and attitudes across the BWLI schools than there was across grade levels (Table T13). Concerning aspects of the program itself, there were many cases where the teacher sentiment varied across the participating schools. Like the Year 2 results (Bebell, 2007), teachers at the Reid school generally reacted somewhat less positively than teachers at the other schools to many of the survey questions. Similarly, teachers from St. Mark generally reported more positively, on average, on the impacts of the 1:1 technology program as they had in past surveys. For example, St. Mark/Joseph teachers averaged 4.8 for the survey item "my role in the classroom has changed" compared to 3.8 for the Conte teachers, and 3.2 for the Reid and Herberg teachers. Teacher responses to the survey question "the school has developed effective policies and procedures for the laptop program" also produced results that varied somewhat across settings. Conte teachers were more favorable of the professional development opportunities they have been provided (3.7) compared with Herberg (3.4), Reid (3.0), and St. Mark/Joseph (3.0). 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."

Lastly, teachers were also presented a list of fourteen 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 (Bebell, 2005; Bebell, 2007). The results reported below are averaged from all of the 108 BWLI primary subject teachers who completed the June 2008 survey. However, a small fraction of teachers did not always answer each and every survey question. Thus, the careful reader will note that the percentages reported below do not always add to 100% as a small percentage of the teacher respondents did not answer each of the given questions. Thus, the percentages reported in the following graphs reflect nearly the full population of primary subject classroom teachers, including even those teachers who chose not answer a given question. Figure T2, on the next page, presents BWLI teachers' beliefs on the impacts of 1:1 computing following three years of participation in the BWLI program.

**Figure T2: Teachers' beliefs on the impact of 1:1 computing across different students (June 2008)**

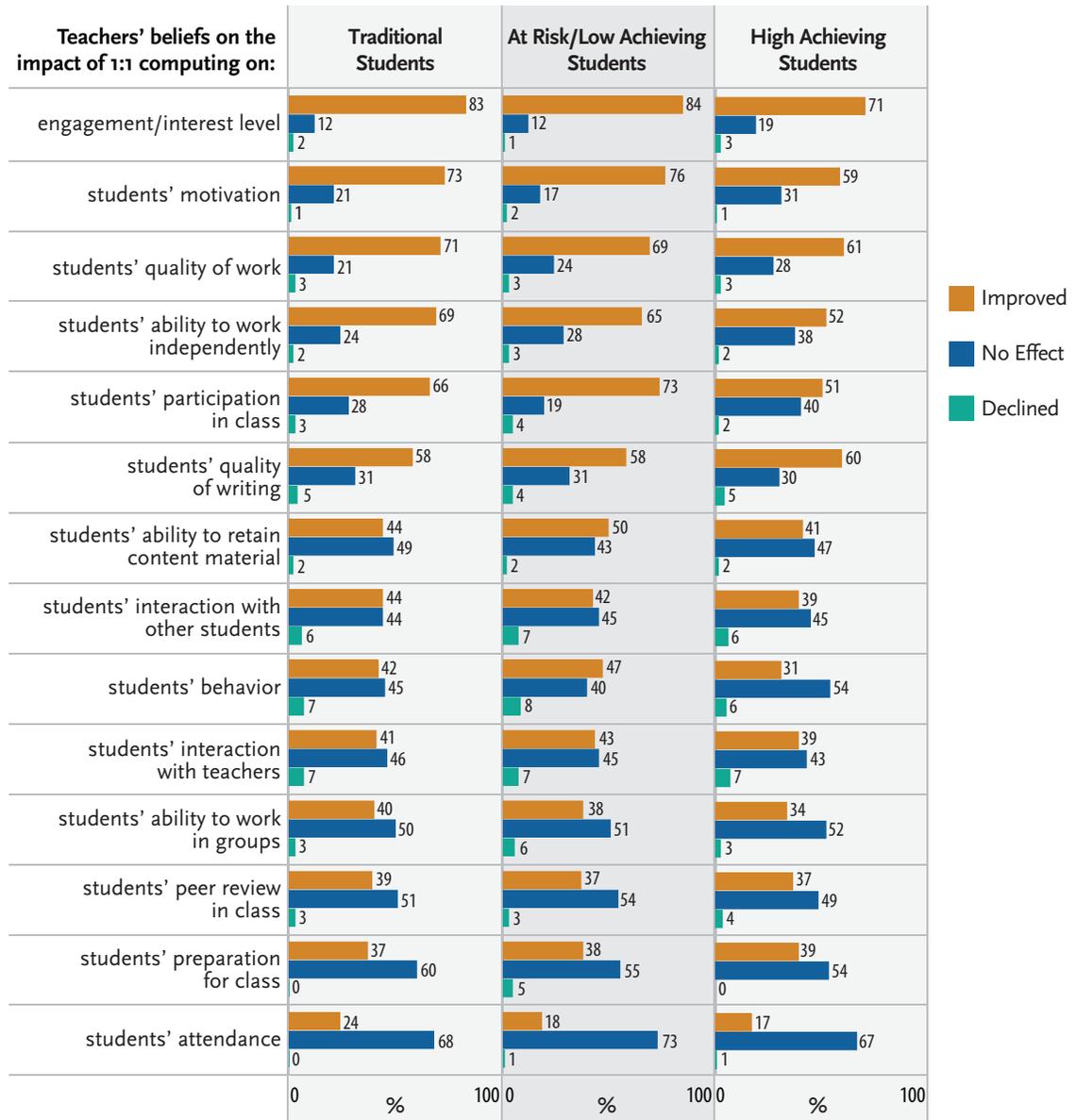


Figure T2 illustrates teachers' beliefs on the impact of 1:1 computing across a wide variety of student behaviors, attitudes, and activities for their traditional, high-achieving, and low-achieving students. The fourteen student outcomes are sorted and organized by the degree of teacher sentiment, such that areas where teachers have observed the greatest improvements are to be found in the top of the figure, while areas with the least improvements are located at the bottom. There is a great deal of information contained within Figure T2, however even a casual glance at the results reveal that participating classroom teachers were substantially more positive in their assessment of the BWLI program outcomes than negative or neutral.

Overall, the overwhelming majority of BWLI classroom teachers reported improvements were most concentrated in their students' interest/engagement in class, students' motivation, and students' quality of work. Focusing only on student engagement, one of the targeted outcomes of the initiative, teachers reported their risk/low achieving students were most improved with 84% of all responding teachers reporting "improvements" in student engagement/interest level compared to 83% for traditional students and 71% for high achieving students. Similar to the results on student engagement, teachers overwhelmingly found that the BWLI program improved their students' motivation. Again, the largest percentage of improvement was observed for at-risk/low achieving students with over 76% of 1:1 teachers reporting that student motivation improved compared to 73% for their traditional students and 59% for high achieving students as a result of their participation in the program. Conversely, a very small minority of teachers (less than 2%) believed that the 1:1 laptops had led to declined student engagement and student motivation for their students.

In addition to most teacher participants reporting that the 1:1 program improved their students' motivation and engagement, the majority of teachers expressed that the program had also served to improve the quality of their students work. This observation was found across all three types of student groupings. However, the category with the highest percent of improvement was for found for traditional students with 71% of 1:1 teachers reporting that students' quality of work improved compared to 69% for at-risk/low achieving students and 61% for high achieving students. More specifically, the survey also addressed the impact on more specific student outcomes, such as the quality of student writing. For all types of students, teachers largely believed that the BWLI program improved the quality of their students' writing. High achieving students' writing quality was seen to benefit most from the 1:1 laptops with nearly 60% of teachers responding that their high-achieving students' writing quality had improved, although at-risk/low achieving students and traditional students were seen to improve by nearly as many teachers. Conversely, a small number of teachers (under 5% for each category) felt that their students' writing had declined as a result of the BWLI program.

Across many of the other student outcomes, teacher sentiment was somewhat less universally positive, such as the impact of 1:1 computing on students' attendance, students' preparation for class, and students' peer review in class. Again, in these cases where teachers were not universally positive in their assessment of the impacts of the program, teacher sentiment was by no means negative. Across the survey items found in the lower half of Figure T2, responding teachers were fairly evenly split between teachers reporting a positive effect and no effect. For example, across 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. However, across all categories of students, less than 2% of teachers reported a decline in their students' ability to retain to content materials after participation in the BWLI program.

Overall, only a very small number of teachers reported a decline in any of the student outcomes related to participation in the BWLI program. In other words, even in those cases where positive outcomes were not reported universally or overwhelmingly by the teachers, there were few instances where more than a tiny fraction of teachers reported negative impacts resulting from the program.