

Bethlehem Area School District
One-to-One Laptop Initiative

Final Report

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Ward Mitchell Cates, Ed.D.
External Evaluation Director

History and Background

The Bethlehem Area School District laptop initiative has just completed its first full school year. Beginning in fall 2003, Broughal Middle School served as the initial test site. At that time, only sixth-grade teachers and their students were involved. At a reception in December 2003 at Lehigh University, Superintendent Lewis expressed a desire for a closer relationship with Lehigh. As a result of conversations with Bethlehem Area School District personnel at the reception, I learned more about the laptop initiative and suggested I might be interested in helping see this innovation evaluated. I volunteered at that time to participate in obtaining outside funding to facilitate such an evaluation.

In January 2004, the other three middle schools joined in the initial implementation, once again involving only sixth-grade teachers and their students. I met in with Dr. Lewis and Scott Garrigan June of 2004 to discuss possibilities and Scott and I worked together and located funding for the evaluation. I spent the next few months preparing a variety of measurement instruments and protocols. All four middle schools implemented the laptop-for-each-student initiative for both sixth and seventh grade in fall 2004.

Data Collection

In mid-October, I interviewed the principals of the four middle schools, as well as the assistant principals for curriculum (sixth grade). Each interview took approximately one hour and used the same interview protocol instrument. During the four weeks from mid-October to mid-November, all sixth and seventh-grade teachers, as well as affiliated special education teachers, were surveyed. The response rate for teachers was quite high; all but a handful completed the survey and returned it. All sixth-grade students were also surveyed during this period. In addition, all sixth-grade teachers were observed teaching one class. These measures were intended to supply baseline data. That is, at this point not all laptops had been distributed, nor were they in frequent use in schools. I felt it was important to collect such baseline data as a method of establishing something against which to compare.

The first week of February 2005, I interviewed all four principals and all four assistant principals for curriculum once again, this time using a slightly modified version of the initial interview protocol. While at each middle school, I left surveys for all sixth and seventh-grade teachers, as well as affiliated special education teachers, to complete. Within a week, I had received the vast majority of teacher surveys. Once again, the response rate was high, although a slightly higher percentage of blank or partially blank surveys were returned. Given that this was a midpoint measurement, I chose not to survey students because I felt it would disrupt instruction. Similarly, I chose not to observe each sixth-grade teacher teaching a second time for this same reason and because it takes approximately one month to complete such observations and the interim report was due in mid-March, less than a month away.

In late April and early May, all 42th grade teachers were observed teaching one class. In May and early June, all sixth and seventh-grade teachers, as well as affiliated special education teachers, were surveyed a final time. In this same time period, all sixth-grade students were also surveyed. In mid-June, I interviewed the principal and assistant principal for curriculum at each of the four middle schools. Once again, the same protocol was used for all interviews, although this protocol was once again slightly modified from the midpoint version, in this case to focus more on summative assessments and reflections.

Reporting Caveats

As an external evaluator, I made clear that the goal of the evaluation was to determine the impact of the 1-to-1 laptop initiative on instruction and the schools. In designing the instruments for this study, I chose to ask some challenging questions and asked respondents to reflect on a wide range of personal and professional issues related to teaching. Some items called for a high level of introspection and candor. I felt it was important teachers and principals felt safe in responding honestly.

To facilitate this, I distributed teacher questionnaires in personalized envelopes they could seal when they returned them to the school office for me to pick up. I made clear in my explanation of the purposes of the study that I was not looking to identify individual teacher's responses or the responses of individual schools and that I would not break the data out in reporting in such a way that this would be obvious. In interviewing the principals, I made the same things clear and said that I would never mention any of them by name in any report, either orally or in writing. Student data were similarly protected. I made no reports to the classroom teacher and this report does not break out student data by teacher, instructional team, or school.

Below I do discuss some differences between sixth and seventh-grade teachers, but those are derived in aggregate across all surveyed teachers. While extrapolated conclusions may hold true on a broader scale, it is quite likely that individual teachers in individual schools might differ dramatically from the conclusions extrapolated for their grade-level cohort.

This study employed classroom observations. Clearly not all instructional activities are suited to the use of technology and one takes the luck-of-the-draw in whether one will see technology in use during a single 50-minute observation. We did not ask teachers to modify their plans and use technology so that we could observe its use. We figured instead that observing classes, regardless of whether they were using technology during that period, would produce a more representative picture of how often and in what ways technology was being used in the schools. Of course, this decision may account for the percentage of teachers who were not using computers during each observation period.

In preparing this final report, I reviewed all previous analyses, including those cited in the *Interim Report* (March 15, 2005). As noted in that report, some sets of surveys were submitted too late to be included. These sets of data have now been coded and included in revising previous analyses. I reviewed all data and identified several computer miscodings that produced minor errors in the interim report. In addition, I worked carefully through all previous observations to identify ones that should not have been included (those of teachers who were not regular 6th grade classroom teachers, the only teachers specified for inclusion in observations). Thus, this final report should be taken as the official report for the project in preference to all previous reports. For that reason, it is comprehensive, including data, text, and conclusions from the interim report, as appropriate.

Lastly, all surveys reported below constitute self-report data. It is important not to mistake self-report data for factual evidence. That is, what someone reports on a survey may or may not be accurate. Self-report data may be affected by respondent awareness, experience, perceptions, and divergent intentions. At no point does this report suggest self-report data represent "truth." The data presented below—whether derived from observation, interview, or survey—make up a complex pattern. The various data points should be used in a connect-the-dots approach as a method of discerning the larger picture.

Findings

This section is divided into four subsections: *Student Findings*, *Teacher Observational Findings*, *Teacher Survey Findings*, and *Principal Interview Findings*. Under each subheading, I discuss relevant data from that data source.

Student Findings

A total of 817 sixth-grade students responded to the baseline student survey in October, while 795 sixth-grade students responded to the final student survey in May. The survey consisted of 59 items across 6 scales. Table 1 details these scales.

Table 1. Distribution of Teacher Survey Items Across Scales (with Reliabilities)

Focus of Scale	Number of Items	Reliability
Student technology skills	18	.871*
Student comparison to "typical" students on technology skills	3	
Student feelings about school and learning	10	.625
Student opinions about technology	9	.630
Student ratings of how technology makes them feel	11	.772
Student preferences for classroom technology uses	8	.778
TOTAL ITEMS:	59	

* NOTE: For purposes of reliability calculations, the first pair of scales was combined.

Table 2 summarizes student responses to items in the six scales used in the survey. Student responses to each scale are discussed beneath the table.

Table 2. Mean Response Data for Baseline and Final Student Survey (By Scale)

Focus of Scale	Baseline Mean Rating	Final Mean Rating	Net Change	% Change
Student technology skills (5)	2.43	2.61	+.18	+3.5%
Student comparison to "typical" students on technology skills (3)	2.32	2.38	+.06	+1.9%
Student feelings about school and learning (4)	3.14	3.14	0	0%
Student opinions about technology (4)	3.22	3.26	+.04	+1.1%
Student ratings of how technology makes them feel (5)	3.98	3.95	-.03	-0.4%
Student preferences for classroom technology uses (5)	3.76	3.77	+.01	+0.3%

Note: Highest possible rating for each scale indicated in parentheses after scale focus description. Higher ratings are better.

As Table 2 illustrates, responses to the first scale went up dramatically, while two other scales went up moderately, and three stayed largely the same. Although Table 2 shows percentage of change for each scale baseline to final, rather than cite results solely by percentages, from this point on this report will discuss differences in terms of **effect size (ES)**. The effect size describes how great an effect a significant change between measurements suggests has taken place. That is, it goes further than a simple significance rating to identify effects in terms of their magnitude. An effect size of **.2** is considered *small*, while an effect size of **.5** is considered *medium*, and effect sizes of **.8 or greater** are considered *large*. It is unusual to see medium and large effect sizes for measures taken eight to nine months apart in real school settings, as is the case here. When one does find effect sizes greater than .2, it usually suggests some marked change that may be related to the treatment. The treatment in this case is taken to be implementation of the laptop initiative, although other influences cannot be eliminated.

The increase in ratings on the first scale across 18 separate technology skills is statistically significant (ES = **+.32**). This scale employs five points, with *one* representing **technology skills** students report they do not have and *five* representing self-reported skills at a level where the student usually helps other students complete a task involving technology. On the baseline, students reported they often needed help to perform almost all of the technology tasks listed. Only four items were rated above 3.0 (*often do alone*), and these included *using word processing* (3.37), *turning the computer on and off* (3.29), *searching the Web* (3.28), and *using a printer* (3.27). Thus, sixth graders apparently did not feel they had much skill in completing most technology tasks.

In contrast, on the final survey seven items were above 3.0 and eight items had increases that were significantly higher (Effect sizes ranging from **+.27** to **+.46**). The final survey results suggest students now view themselves as able to handle many technology tasks independently (*often do alone* or help others). The technology tasks they see themselves needing help on or not doing include *using databases* (2.49), *making graphics and editing pictures* (2.42), *using CD-ROMS* (2.24), *making videos* (1.83), *taking digital photos* (1.73), *editing videos* (1.70), *doing email* (1.60), and *using a scanner* (1.51). A number of these are technology tasks not currently completed in the schools and thus may have received lower values because many respondents answered *don't do*. Despite this fact, mean ratings on only two items were not notably higher on the final survey (*using the scanner* and *editing videos*).

Ironically, when asked to compare their skills to those of "typical" students, the surveyed sixth graders described themselves on the baseline as about one-third of the way between *about the same* and *better* (mean = **2.32** out of 3.0). Thus, although they did not rate themselves as strong in completing these technology tasks, they appeared to believe that other students were not much stronger. Despite the significant increases in students' assessments of their independence in completing technology tasks, they did not raise their assessment of comparison to "typical" students much (mean = **2.38** out of 3.0).

Students were asked to rate how they feel about **school and learning**. On a four-point scale, they rated themselves on the baseline at a mean of **3.14**, the same mean rating as on the final survey. This means that they rated most statements in this section of the instrument as being *usually true* of them. The statements in this section with which students agreed most strongly included *School prepares me well for the future* (means = **3.53**, baseline; **3.59**, final) and *When I do well in school, it is because I have tried hard* (means = **3.53**, baseline; **3.51**, final). The two items with which they most disagreed were *When I do badly in school, it is the teacher's fault* (**2.30** baseline, **2.34** final) and *How I do in school is completely out of my control* (**2.43** baseline and **2.41** final).

The next section of the instrument asked students their **opinions about technology**. On a four-point scale (*not true!* to *always true!*) the mean for items in this section was **3.22** on the baseline and **3.26** on the final survey. This means student respondents on average rated the statements on this scale as about one-quarter of the way between *usually true* and *always true!* Two items in this scale had effect sizes were equal to or greater than .2: Students assigned a mean rating of **3.42** to *I can do assignments when I have to use the computer*, up **.17** from the baseline (ES = **+.20**) and *The teachers in my school know how to use technology* went down **.15** from the baseline to **3.13** on the final survey (ES = **-.20**). One of the highest rated items in this section on both baseline and final survey was *I want to use a computer more* (means = **3.60** and **3.57**, respectively). The items on this scale with which they disagreed most on both baseline and

final survey were *Computers are a waste of time* (means = **2.17** and **2.11**) and *Technology makes it harder for me to get my work done* (means = **2.35** and **2.27**).

Students were asked next to respond to statements about **how technology makes them feel**. On a five-point scale from *never* (1) to *all of the time* (5), students assigned a mean rating of **3.98** to statements in this section on the baseline and **3.95** on the final survey. This suggests they felt the statements were true *most of the time*. The highest rated items on both baseline and final was *I like using computers in class* (means = **4.51** and **4.48** respectively). The items with which students expressed the greatest disagreement were *When we use computers, I feel left out* (means = **1.17** baseline and **1.15** final), *I get nervous when we will be using technology* (means = **1.28** and **1.21**), and *I have trouble with the software we use in class* (means = **1.65** and **1.58**). Only one item on this scale had a baseline-to-final effect size of .2 or greater: *I'm excited when I get to use a new computer program*. This item went from **3.92** (baseline) to **3.66** (final), producing an effect size of **-.20**.

The final section of the student baseline survey asks students to tell how much they like particular **uses of technology in the classroom**. They were asked to rate such uses on a five-point scale from *I don't like it!* (1) to *It's great!* (5). Across the eight items in this section, students assigned a mean baseline preference of **3.76**, about three-quarters of the way from *It's OK* to *It's good*. This mean rating went up slightly to **3.77** on the final survey. The uses they rated most highly included *going online to look for facts or materials* (**4.06** and **4.11**, respectively) and *doing research on the computer to complete an assignment* (**4.01** and **4.08**, respectively). Only one item on the scale showed a baseline-to-final change that met the .2 effect size threshold: *My group uses a computer to prepare a report or presentation*. The mean for that item went from **3.79** on the baseline to **4.08** on the final, making it one of the best liked activities (ES = **+.25**). It is interesting to note that these top three uses are ones facilitated by having individual laptops.

Teacher Observational Findings

The baseline employed 42 separate classroom observations of approximately 50 minutes each for a total of 2100 minutes. A single individual served as the observer for all baseline observations. Of the 42 sixth-grade teachers observed, 37 made no use of computers while the observer was present, while 5 used computers in some way. These 5 teachers used computers for a total of 139 minutes among them. This constitutes 6.6% of the total observed time. In the five classes where computer use was observed, its use constituted 55.6% of the observed time, leaving 44.4% of the time for classroom activities not involving computers. Table 3 on the next page illustrates the division of the observed use by minutes devoted to each activity, including minutes spent not using the computer.

Table 3. Observed Computer Use by 42 6th Grade Teachers (in minutes, divided by observation period/activity)

Activity	School 1		School 2		School 3		School 4		TOTAL	
	Baseline (n=1)	Final (n=5)	Baseline (n=3)	Final (n=4)	Baseline (n=0)	Final (n=6)	Baseline (n=1)	Final (n=8)	Baseline (n=5)	Final (n=23)
Whole-class Use	1.5	31.5	87.5	11.0	0	85.0	27.5	0	116.5	127.5
Student Team Use	0	44.0	0	62.5	0	0	0	73.0	0	179.5
Individual Student Use	0	19.0	0	26.0	0	73.5	0	138.5	0	257.0
Students Learning Tech	0	0	20.0	0	0	0	0	0	20.0	0
Teacher Administrative Use	0	6.5	0	0	0	0	0	18.0	0	24.5
Handling Tech Problem/Setup	0	5.0	2.5	3.5	0	0	0	19.0	2.5	27.5
No Computer Use	48.5	144.0	40.0	97.0	0	141.5	22.5	151.5	111.0	534.0
Total	50.0	250.0	150.0	200.0	0	300.0	50.0	400.0	400.0	1150.0

Table 3 also shows that of the four middle schools where 6th grade teachers were observed in the baseline, one school had no teacher observed using computers (School 3), two had one teacher that used computers during the observation (Schools 1 and 4), and the final school had three teachers observed using computers (School 2). Thus the percentage of a school's teachers observed using computers ranged from 0% to 33.3%, with 11.9% of the 42 teachers observed using computers during the baseline.

These figures illustrate clearly that there was very little use of computers at this point in time among the observed classes. Given that these observations were taken as a baseline and that laptops were in the process of being distributed during this period, however, these findings are not necessarily surprising. The major result of having so little computer use to observe, however, is that other issues were not illuminated particularly well by these observations. For example, scales on the observation instrument investigate the **apparent instructional effectiveness of the technology use**; **technology equity issues** related to gender, academic achievement level, and race; **teacher apparent comfort with technology**; and a **holistic assessment of technology's influence on the observed lesson**. Given that fewer than one in eight teachers was observed using computers in the classroom, as well as the nature of the observed use, there was little useful information noted on these other scales.

The final observations also entailed 42 observations of one period of approximately 50 minutes. Once again, a single observer recorded all final observations, although the final observer was a different person than the baseline observer. This change in observer should pose no reliability threat, however, since the only common tasks completed by both observers were to identify the use of computers in observed classes and record the percentage of time consumed by each type of use. These are relatively simple and reliable mechanical recording tasks.

Final observations showed a rather different pattern than baseline. Twenty-three of the 42 teachers used computers (54.8%). As Table 3 shows, the 23 teachers were distributed across the four middle schools, with 4 teachers at one school, 5 at another, 6 at the third school, and 8 at the final school. The percentage of teachers observed using computers at individual schools ranged from 44.4% to 62.5%. As compared to the baseline, these figures represent a 460% increase in observed computer use among 6th grade teachers.

Of the total 1150 minutes of observation of teachers who were using computers, these 23 teachers used computers for a total of 616 minutes (53.6%). Thus, these teachers worked on classroom activities not involving computers 46.4% of the observed time (534 minutes). The 616 minutes of computer use represents 29.3% of the total observed time of 2100 minutes and represent almost four and a half times as much observed use as in the baseline.

In addition, Table 3 illustrates how the ways in which observed teachers used computers had changed and diversified. Whereas *whole-class use* dominated baseline use (46.6%), followed by *helping students learn to use computers* (8.0%), in the final observations *whole-class use* accounted for only 11.1% of observed use (127.5 minutes) and no time was used in helping students learn to use computers. In contrast, the major observed uses of computers were *individual student use of computers* (257 minutes, 22.3%) and *use of computers by a team of students* (179.5 minutes, 15.6%).

Unlike the situation with the baseline observations, with over half of the observed teachers using computers during final observations, we were able to record substantial additional information on the other scales of the observation protocol. The observer viewed computer use and rated the extent to which boys and girls, various racial/ethnic groups, and students of apparent varying academic talent had equal opportunities during the observation. She recorded this information on a five-point scale from *much less often* (1) to *much more often* (5). Across the 23 observations the mean ratings for **gender equality** (3.00, *about the same* for boys and girls), **academic talent** (3.17, slightly favoring apparently less academically talented), and **race/ethnic group** (3.05, *about the same*). This suggests equal opportunity in computer use was not an issue for the observed classes.

The observation protocol also recorded **teacher apparent comfort with technology** on a four-point scale from *not comfortable* (1) to *very comfortable* (4). The 8 items in this section of the protocol addressed setting up and operating technology and handling problems. Three of these items addressed tasks that were not completed during the observations or that were completed by only a single teacher. Table 4 shows the remaining five items that dealt with tasks observed for between 6 and 14 (26.1% to 60.9%) of the 23 teachers, as well as the mean ratings for each.

Table 4. Final Observation Mean Ratings of Teacher Apparent Comfort with Technology (divided by task)

Observation Item Task	Applicable # of Teachers Observed	Mean Rating (of a possible 4)
Setting up equipment.	9	3.00
Handling minor technical problems.	12	3.00
Maintaining lesson flow while changing from one technology to another.	14	3.57
Helping students use technology.	13	3.38
Using traditional technologies (overhead, slide projector, tape recorder)	6	3.67

As Table 4 illustrates, the six to 14 teachers who were observed completing these tasks were least comfortable with **setting up equipment** and **handling minor technology problems** (both *somewhat comfortable*). In terms of **helping student with technology**, however, the 13 teachers observed doing so were more than one-third of the way to *very comfortable*. And in **maintaining lesson flow while changing from one technology to another**, the 14 observed teachers were rated as more than half way to *very comfortable*. Finally, the six teachers who were observed **using traditional technologies** appeared quite comfortable, with four of the six rated as *very comfortable* and the other two *somewhat comfortable*.

The protocol required the observed to judge the **apparent instructional effectiveness** of 12 possible uses of computers on a five-point scale from *Did not enhance!* (1) to *Enhanced markedly!* (5). Of these 12, the observer only saw three uses employed by more than one-quarter of those observed. Table 5 on the next page details these three uses.

Table 5. Final Observation Mean Ratings of Apparent Instructional Effectiveness of Computer Uses

Observed Computer Use	Applicable # of Teachers Observed	Mean Rating (of a possible 5)
Word processing	9	3.89
Using teaching/learning programs	9	4.00
Searching the Internet/Web	9	4.44

Table 5 shows that use of word processing in the observed lesson enhanced instruction somewhat, while use of teaching/learning programs enhanced instruction quite a bit. Clearly, use of Internet/Web searches had the greatest apparent impact for the nine teachers observed employing it, with a rating almost halfway to the highest level of enhancement. Given the generally high rated effectiveness of these three instructional uses, it is worth noting that 20 of the 23 teachers (87.0%) incorporated at least one of these three uses during their observed lesson.

Finally, the observer was asked to make a series of **holistic assessments** of how well technology was used and how much its use contributed to the lesson as a whole. This scale consisted of 10 assessments, each of which was expressed as a positive influence of technology to which observer agreement was rated from *strongly disagree* (1) to *strongly agree* (5). The observer was able to assign holistic assessments to either 20 or 21 teachers who used technology, based on the nature of the statement. Table 6 details the statements, number of teachers assessed, and the mean rating of agreement for that statement.

Table 6. Final Observation Mean Holistic Assessments of Instructional Use of Technology

Observation Item Task	Applicable # of Teachers Observed	Mean Assessment (of a possible 5)
Students appeared comfortable using technology.	20	4.85
Technology used seemed well matched to instructional tasks to be accomplished.	20	4.80
There was enough technology available to accomplish intended tasks.	21	4.76
When working with technology, students seemed self-directed.	20	4.70
Students appeared engaged by the lesson.	21	4.62
Instructional pacing felt smooth with technology causing few interruptions.	20	4.60
Technology not used for its own sake, but to enhance lesson.	21	4.48
Use of technology did not cause discipline or classroom management problems.	21	4.43
Teacher appeared well focused on lesson and little distracted by technology.	20	4.25
Students appeared excited about using technology.	20	3.75

These are quite high levels of agreement. The one reality check in the group is the 3.75 mean for student excitement working with technology. Given that observations were made at the end of the year and that students had been working for many months with laptops, this assessment is not surprising. Positive findings include the extremely high assessment of student comfort using technology, that observed technology use was well matched to instruction, and that enough technology was available (a likely benefit of all students having individual laptops). In terms of classroom management, the students were assessed as self-directed and engaged, and the use of technology was not judged to create discipline or pacing problems, nor did technology appear to distract the teacher from his/her lesson.

Teacher Survey Findings

A total of 110 teachers participated across the three surveys: 103 teachers completed the baseline teacher survey, while 97 teachers completed and returned the midpoint survey, and 84 completed the final survey. Not all teachers completed all items on all surveys, however.

Of the 110 respondents, 38 were male and 72 were female. The distribution of the 110 teachers across respondent groups, as well as their reported years of teaching experience and reported level of experience with using computers in the classroom are reported in Table 7 below.

Table 7. Demographic Information on Teacher Survey Respondents

Level	N	Years Teaching Experience	Years Used Computer in Classroom
6 th grade	47	13.3	4.3
7 th grade	43	11.7	4.9
Special Education	20	13.6	5.5
Total / Means	110	12.6	5.07

Following demographic items, there are 159 items on the teacher survey that ask the respondent to express agreement with a statement, rate something, or report a use or activity. As Table 8 illustrates, these items are distributed across 13 scales.

Table 8. Distribution of Teacher Survey Items Across Scales (with Reliabilities)

Name of Scale	Number of Items	Reliability
Previous Training's Value in Preparing for Technology Use	7	.877*
Value of Types of Future Training	17	
Teacher Role in Student Success	9	.765*
How Much Difference Teacher Makes	14	
Teacher Confidence and Comfort with Technology	13	.877
General School Support for Technology Use	10	.746
Quality of Tech Support	3	.758
Integration of Computers in the Classroom	12	.867
Beliefs about Technology's Value in Education	21	.846
Teacher Use of Types of Software	15	.840
Student Use of Types of Software	15	.893
Student Independence Using Technology	20	.903*
Comparison to "Typical" Students	3	
TOTAL ITEMS:	159	

* NOTE: For purposes of reliability calculations, some pairs of scales were combined.

In the discussion that follows, I emphasize baseline-to-final differences. Differences that occurred baseline-to-midpoint were discussed in the interim report and, if persistent, should be reflected in baseline-to-final differences. Once again, effect sizes are used to identify the magnitude of any significant differences.

Table 9 on the next page lists the baseline and final means, as well as effect sizes. Means are expressed as the aggregated total of responses to all items in a scale. Scales are sorted by effect size, regardless of positive or negative direction.

Table 9. Baseline and Final Teacher Survey Mean Response Data (Aggregated by Scale, Sorted by Effect Size)

Name of Scale	Baseline Mean	Final Mean	Net Change	Effect Size
Student Independence Using Tech / Comparison to “Typical” Students	57.93	68.79	10.86	0.83
Teacher Role in Student Success / How Much Difference Teacher Makes	92.39	85.58	-6.81	-0.74
Previous Training’s Value in Preparing for Tech Use/ Value of Types of Future Training	70.16	63.77	-6.38	-0.53
Quality of Tech Support	10.10	11.06	0.96	0.38
Integration of Computers in the Classroom	37.32	40.33	3.01	0.33
General School Support for Technology Use	32.63	34.36	1.73	0.31
Student Use of Types of Software	35.70	37.50	1.80	0.20
Beliefs about Technology’s Value in Education	81.04	79.71	-1.34	-0.16
Teacher Confidence and Comfort with Technology	49.81	50.18	0.36	0.05
Teacher Use of Types of Software	38.31	38.38	0.07	0.01

As Table 9 shows, 7 of the 10 scales exhibited changes that met the .2 effect size threshold. In addition, 73 of 159 items (45.9%) exhibited effect sizes equal or greater than .2 with 45 of these effect sizes being positive and 28 being negative. It is important to recognize that negative changes may not be undesirable. Every scale had at least one item that exhibited a significant change. The changes from baseline to final are discussed in order of effect size (regardless of direction).

The largest scale effect size change was in teacher ratings of **student independence using technology and comparing these students’ tech skills to those of “typical” students** (ES = +.83, *large* effect). Twenty of the 23 items on this scale (87.0%) changed significantly, all for the positive, with effect sizes ranging from +.26 (*small*) to +1.14 (*large*) and seven effects qualifying as *medium*.

The **student independence** portion of the scale asks teachers to rate how much help students need in completing various hardware and software tasks on a five-point scale from *my students don’t do* (1) to *all of my students do without help* (5). Three of the item means in this scale were between 3 (*many of my students do without help*) and 4 (*most of my students do without help*), while six items had means between 4 and 5 (*all of my students do without help*). These 9 items (45.0%) suggest a high level of student independence with those particular tasks. The large percentage of effect sizes greater than .2 suggest that even with tasks where not all students are working independently, there has been significant growth in independence. The three tasks that did not show dramatic change included *using a scanner* (ES = .00), *using email* (ES = +.09), and *using the collaborative writing program: SubEthaEdit* (ES = +.18). There appear to be few scanners available presently in the schools and it appears students do not use email in class. The mean value for SubEthaEdit use came up just short of the .2 threshold.

Even including these three items, the baseline mean for student independence was **2.63**; the midpoint was **2.95**; and the final was **3.09**. Teacher reports on the level of help students need in using technology show clear growth. Interestingly, among the tasks with the greatest positive change were *searching Internet/Web* (ES = +.69) and *preparing presentations* (ES = +1.14), the former being a highly rated instructional use of computers (4.44) from the final classroom observations while the latter is use that was highly rated for apparent instructional effectiveness (4.50) but was observed employed by only four teachers and thus not highlighted earlier.

The **comparison to “typical students”** portion of this scale asks teachers to compare their students to “typical” students in terms of use of computers, use of software, and learning to use new technology. Teachers choose *worse* (1), *about the same* (2), or *better* (3). Table 10

shows the means for these three items on both baseline and final, as well as mean change and effect sizes.

Table 10. Baseline and Final Mean Teacher Response for *Comparison to “Typical” Scale* (with Effect Size)

Item	Baseline Mean Rating	Final Mean Rating	Net Change	Effect Size
In using computers, my students are...	2.21	2.40	+ .19	.31
In using software, my students are...	2.09	2.27	+ .18	.32
In learning new technology, my students are...	2.18	2.35	+ .17	.29

These mean ratings suggest teachers view their students as better than “typical” students in terms of technology. This represents a clear trend, since these three ratings climbed baseline-to-midpoint and midpoint-to-final.

The second largest effect size in Table 9 was **teacher role in student success / how much difference teacher makes** (ES = -.74). The first 9 items in this scale offer statements about the teacher’s role and ask teachers to express agreement on a five-point scale from *strongly disagree* (1) to *strongly agree* (5). The next 14 items ask respondents to use a five-point scale from *nothing* (1) to *a great deal* (5) to rate how much they can do to achieve educational goals. Table 11 presents baseline, midpoint, and final means for all 23 items, sorted by final survey mean. That table also indicates the baseline-to-final effect size for each item.

Table 11. Baseline, Midpoint, and Final Mean Teacher Ratings for *Teacher Role / Make Difference Scale* (with Effect Size, Ordered by Final)

Item	Baseline Mean	Midpoint Mean	Final Mean	Baseline -to-Final Effect Size
To provide a challenging academic environment?	4.29	4.07	4.20	-0.15
I am confident that I can deal with unexpected events in my classroom and school.	4.22	4.18	4.18	-0.07
When confronted with a problem, I can usually find several solutions.	4.20	4.08	4.10	-0.19
I make a real difference in my school.	4.08	4.03	4.08	0.01
To get students to trust teachers?	4.11	4.04	4.02	-0.13
I can always manage to solve instructional problems if I try hard enough.	4.13	4.02	4.00	-0.19
To tailor content and delivery to meet individual learning needs?	4.12	4.01	3.99	-0.19
To get students to believe they can do well in school?	4.21	3.88	3.98	-0.35
To help students think critically?	4.09	3.87	3.95	-0.21
To get students to work together?	4.10	3.94	3.88	-0.33
I can reach almost any student.	3.93	3.88	3.87	-0.09
While all teachers can get down, I tend to bounce back quickly because I know I'm doing a good job.	3.91	3.84	3.87	-0.06
To keep students on-task on difficult assignments?	4.03	3.93	3.82	-0.34
To make students enjoy coming to school?	3.94	3.71	3.74	-0.29
To reach the most difficult students?	4.24	3.72	3.71	-0.19
To motivate students who show little interest in schoolwork?	3.78	3.65	3.68	-0.14
To promote learning when there's little support from home?	3.73	3.52	3.62	-0.14
I won't burn out as a teacher because I am good at it and I constantly find new and exciting challenges.	3.71	3.69	3.58	-0.15
When my students have difficulty learning, it is usually [not] because I have not taught them well enough.*	3.36	3.59	3.50	0.16
To help other teachers with their teaching skills?	3.62	3.40	3.40	-0.26
To involve parents and families?	3.40	3.25	3.27	-0.17
To reduce student absenteeism?	3.05	2.85	2.98	-0.09
A student's family [does not] influence his or her academic success more than I do.*	2.21	2.20	2.15	-0.07

? Note1: All items above ending in a question mark are drawn from the *Make Difference* portion of the scale, while the others are from the *Teacher Role* portion.

* Note2: Words in brackets indicate item was reversed on the survey.

Table 11 shows that teachers report progressively lower perceptions of being able to make a difference at year-end than they did in October. In fact, looking at the effect sizes, only two are not negative and of those only *When my students have difficulty learning, it is usually [not] because I have not taught them well enough* actually went up baseline-to-final. Eleven of the items (52.4%), however, had higher means on the final than on the midpoint.

Table 9 shows **previous training’s value in preparing for tech use** and **value of types of future training** as the third largest effect size (ES = **-.53**). This scale lists seven possible sources of previous preparation to use technology and asks the respondent to rate the extent to which he or she acquired skills from that source. The scale next lists 17 different types of training and asks the respondent to rate the potential benefit of each on a five-point scale.

Of the 7 sources listed, only one source showed a significant increase in teachers attributing their computer skills to its role. That source was *in-service courses and workshops* and showed a mean change from **2.85** on the baseline to **3.23** on the final (ES = **+.51**, *medium*).

Of the 17 different types of training listed, all showed marked drops in perceived benefit baseline-to-final. The mean differences ranged from **-.22** to **-.57**. Table 12 lists the ratings of potential benefit teachers assigned to the 17 types of training, ordered by their final rating of each.

Table 12. Baseline and Final Mean Teacher Ratings for *Training Benefit Scale* (with Effect Size, Ordered by Final)

Item	Baseline Mean	Final Mean	Net Change	Effect Size
Subject area-specific training in integrating technology into teaching and learning.	3.68	3.24	-0.44	-0.47
Training in district-, school-, or classroom-specific software packages and/or Websites	3.69	3.20	-0.49	-0.60
General training in how to integrate technology use into the classroom	3.49	3.04	-0.45	-0.45
Training in how to use technology to enhance student research skills	3.51	3.02	-0.49	-0.50
Training in using technology to support student collaboration and team work	3.57	3.00	-0.57	-0.60
Simple tech troubleshooting	3.38	2.95	-0.43	-0.44
Presentation software use	3.27	2.86	-0.41	-0.47
More advanced Web tips	3.24	2.77	-0.47	-0.47
More advanced database tips	3.15	2.76	-0.39	-0.37
More advanced spreadsheet tips	3.15	2.71	-0.43	-0.41
Use of digital cameras and camcorders	3.15	2.69	-0.46	-0.43
More advanced word processing tips	2.98	2.60	-0.39	-0.37
Database basics	2.96	2.55	-0.41	-0.40
Spreadsheet basics	2.88	2.53	-0.35	-0.35
Internet and Web basics	2.61	2.33	-0.29	-0.27
Word processing basics	1.98	1.76	-0.22	-0.22
Introductory computer basics	2.03	1.63	-0.40	-0.40

While Table 12 shows a decrease in perceived benefit for all 17 types of training, it is interesting to note that there are still 5 types of training that are at or above the middle position (*moderate* benefit) and that these five are ones that were among the top rated types on the baseline as well. While all 17 types rated at (or within .02 of) at least *small* benefit on the baseline, two types of training –*introductory computer basics* and *word processing basics*—are now below that level, suggesting a sizable portion of teachers rated them as of *no* benefit. In general, all “basic” training now seems of lower perceived benefit.

As Table 9 shows, **quality of technology support** was the scale with the next largest effect size (ES = **+0.38**). This scale asks teachers to express agreement with three statements about support using a five-point scale from *strongly disagree* (1) to *strongly agree* (5). Table 13 shows the baseline and final mean ratings for these three items, as well as net change and effect sizes.

Table 13. Baseline and Final Mean Teacher Response for *Quality of Tech Support Scale* (with Effect Size)

Item	Baseline Mean Rating	Final Mean Rating	Net Change	Effect Size
I have enough access to tech support to resolve hardware, software, and tech use problems.	3.01	3.48	+ .47	.46
I [do not] have to contact our tech-support person several times before I get assistance.*	3.29	3.62	+ .33	.31
The on-site tech-support person is committed to getting the technology running and keeping it running well.	3.81	3.96	+ .16	.17

* Note: Words in brackets indicate item was reversed on the survey.

Two of the three changes qualify as *small* (but significant) effects, with one near *medium*. The third item did not reach the .2 threshold, but it began at such a high level that ceiling effects may have limited its subsequent increase.

The fifth largest effect size in Table 9 is **integration of computers in the classroom** (ES = **+0.33**). This scale lists a variety of ways to use technology and asks the teacher to rate frequency of use on a five-point scale from *not at all* (1) to *every day* (5). Table 14 shows the baseline and final means, net change, and effect sizes for all 12 items. It lists items in descending order, based on final reported frequency of use.

Table 14. Baseline and Final Mean Teacher Ratings for *Training Benefit Scale* (with Effect Size, Ordered by Final)

Item (Uses)	Baseline Mean	Final Mean	Net Change	Effect Size
Independent learning (students working alone on individual computers)	3.93	4.05	+ .12	0.12
As a research and class preparation tool for you	3.84	4.01	+ .17	0.15
Individual instruction (one student on one computer)	3.67	3.96	+ .29	0.27
As an instructional resource for students (Websites, online files)	3.38	3.65	+ .28	0.26
As a research tool for students	3.11	3.45	+ .35	0.33
As a productivity tool for students (create charts, reports, other products/artifacts)	3.28	3.37	+ .09	0.09
As a communication tool for you and your students (email, electronic discussion)	2.97	3.33	+ .35	0.21
As a problem-solving tool for students	3.11	3.28	+ .17	0.16
Cooperative groups (teams working on computers)	3.05	2.92	-.13	-0.11
As a classroom presentation tool for you and/or your students	2.56	2.79	+ .22	0.19
Whole class instruction (one computer as central focus)	2.37	2.69	+ .31	0.25
Small group instruction (teaching subgroup of students using a single computer)	2.08	2.61	+ .54	0.43

As Table 14 shows, only one of 12 uses has lower reported frequency on the final than on the baseline: *use by cooperative groups*, and that effect size is less than .2 (as well as the reported final frequency still hovering close to the *once a week* point on the scale). In fact, it appears to be a verified common use of computers by sixth-grade teachers, since *use of computers by a team of students* made up 15.6% of observed computer use during the final set of observations (see Table 3). The two most frequent reported uses are for *independent learning by students* and as a *teacher research and class preparation tool*. On the five-point scale, these equate to *several times a week*. These were the two most frequent uses reported on the baseline as well. Although both final frequency means are higher than on the baseline, the change does not meet the .2 threshold.

The next use in Table 14 is *individual instruction* and teachers report it is also used close to *several times a week*. The increase from baseline to final was significant, with an effect size of **+.27**. This seems to confirm what the observer found in final observations, where *individual student use of computers* constituted 22.3% of observed computer use. The next five uses are reportedly used more than once a week, but less than several times a week. Of these five, four had effect sizes larger than **+.2**. Of the final four uses in the list that are used less frequently than once a week, two have effect sizes greater than **+.2**. These two, *whole class instruction* and *small group instruction*, are the least frequently reported uses of computers, but both have increased notably from baseline. In particular, *small group instruction* showed the greatest change, moving from *once a month or less* to almost two-thirds of the way to *once a week*.

Going back to Table 9, we find the next largest scale effect size is for **general school support for technology use** (ES = **+.31**). This ten-item scale addresses time, access, nature of training, and administrative encouragement. Respondents are asked to rate their agreement with a series of statements, using a five-point scale from *strongly disagree* (1) to *strongly agree* (5). Six of the 10 items met the .2 effect size threshold, all positive (see Table 15).

Table 15. Baseline and Final Mean Teacher Ratings for Key Items from *General School Support Scale* (with Effect Size, Ordered by Final Mean)

Item	Baseline Mean	Final Mean	Net Change	Effect Size
The administration supports technology-related training.	3.70	3.87	+17	.22
My school gives me enough tech-related support.	3.09	3.39	+31	.32
I have had adequate training in using computers.	3.12	3.36	+24	.22
Training is offered often enough to meet my needs.	2.97	3.29	+32	.34
Teachers [do] have enough time to develop good instruction using technology. *	2.46	2.71	+26	.26
I have enough time to learn computer skills	2.45	2.68	+23	.23

* Note: Words in brackets indicate item was reversed on the survey.

While these six statements showed significant baseline-to-final increases, it is perhaps useful to examine the final means as a way of gauging teacher end-of-year sentiment. Respondents have moved substantially closer to *agree* in terms of their rating of administrative support for training. This suggests an enhanced perception of such support. The next three statements in Table 15, however, are ones where respondents are only one-third or so higher than *neutral* in their final mean responses. This suggests either that many respondents are undecided on these statements or perhaps that some group of teachers is in greater agreement, while another is in lesser. The final two statements in Table 15 are ones that have moved from halfway between *disagree* and *neutral* to two-thirds of the way. While this is desirable, once again, it

suggests at least some sizeable portion of respondents still disagree with these statements. Thus, it appears that there may be room for improvement in teacher perception of general school support.

The **student use of types of software** scale in Table 9 had an effect size of **+0.20**. Teachers were asked to tell the frequency with which their students used 15 types of software. The scale offered five points, from *not at all* (1) to *every day* (5). Eight of these items showed significant changes in reported frequency baseline-to-final. Table 16 lists all 15 uses, ordered by final survey reported frequency of use.

Table 16. Baseline and Final Mean Teacher Ratings for *Student Software Use* (with Effect Size, Ordered by Reported Frequency)

Item (Type of Software)	Baseline Mean	Final Mean	Net Change	Effect Size
Word processor (AppleWorks, Open Office, etc.)	3.81	4.02	+0.21	.23
Web browser (Internet Explorer, Netscape, etc.)	3.67	3.91	+0.25	.26
Online search engines (Google, Yahoo, MSN, etc.)	3.35	3.70	+0.34	.31
Websites with downloadable images or files.	2.96	3.24	+0.28	.22
Drill and practice (quiz programs, self-test and practice programs, multiplication drills, etc.)	2.58	2.89	+0.31	.25
Educational games (Tom Snyder products, History Concentration, Alien Rescue, etc.)	2.89	2.89	+0.01	0
Presentation software (Keynote, PowerPoint, etc.)	1.88	2.36	+0.48	.58
Graphics (iPhoto, PhotoShop, GraphicsConverter, etc.)	1.91	2.22	+0.30	.31
Teaching and learning programs (Geometer's Sketchpad, MasterKey, etc.)	2.00	2.09	+0.09	.08
Spreadsheet (AppleWorks, Open Office, etc.)	1.93	2.07	+0.15	.15
Database (AppleWorks, Open Office, etc.)	1.73	1.78	+0.05	.05
Audio capture / editing (Audio Recorder, Finale Notepad, QuickTime, etc.)	1.54	1.67	+0.13	.15
Simulations (Sim City, Sim Ant, etc.)	1.66	1.54	-0.12	-.12
Movie-making (iMovie)	1.50	1.52	+0.02	.03
Collaborative writing (SubEthaEdit)	1.74	1.52	-0.21	-.21

As Table 16 shows, the top four student uses remain the same baseline-to-final, although all show a marked and significant increase in reported use. Reported student use of drill-and-practice software jumped ahead of educational games (whose reported use was unchanged). The single greatest change was in reported use of presentation software, which is now used approximately *once a month*. Graphics software exhibited a similar rise in frequency of use and is also now reportedly used about once a month.

The three types of software reported as having the lowest frequency of use were simulations, movie-making, and collaborative writing. These same types of software were rated as three of the least frequently used pieces of software on the baseline (and on the midpoint). While simulations showed lower reported student use on the final than on the baseline, that difference had an effect size less than .2. Only one use showed lower reported frequency of use at that level on the final survey: *collaborative writing* software. This would appear to confirm the **student independence** finding cited earlier, where the baseline-to-final mean comparison for SubEthaEdit was one of only three with effect sizes below .2.

Overall, these analyses sustain the conclusions of the interim report. That is, teachers perceive themselves as becoming more competent with technology themselves, report they are integrating technology in more ways than they anticipated, and are finding their students more competent with technology and more independent in its use than expected.

Subgroup Findings for 6th Grade, 7th Grade, and Special Education Teachers

The findings above hold true in general for all teacher groups, but there are some findings that differ by respondent subgroup. This section discusses how findings for each of the three subgroups differ from the overall findings discussed above. Table 17 shows the baseline and final means and effects sizes for **all respondents** and then each of the three respondent groups, ordered by effect size for the overall group, regardless of positive or negative direction.

Table 17. Baseline and Final Teacher Survey Mean Response Data By Respondent Groups (Aggregated by Scale, Sorted by All Respondents Effect Size)

Scale	All Respondents (n=103)			6 th Grade (n=42)			7 th Grade (n=43)			Special Education (n=18)		
	Baseline Mean	Final Mean	Effect Size	Baseline Mean	Final Mean	Effect Size	Baseline Mean	Final Mean	Effect Size	Baseline Mean	Final Mean	Effect Size
Student Independence Using Tech / Comparison to "Typical" Students	57.93	68.79	0.83	59.61	70.00	0.84	60.76	70.21	0.81	47.67	65.08	1.28
Teacher Role in Student Success / How Much Difference Teacher Makes	92.39	85.58	-0.74	92.27	84.64	-0.91	93.17	86.65	-0.72	90.78	86.86	-0.36
Previous Training's Value in Preparing for Tech Use/ Value of Types of Future Training	70.16	63.77	-0.53	69.31	67.23	-0.20	70.77	60.93	-0.76	70.50	61.25	-0.76
Quality of Tech Support	10.10	11.06	0.38	10.02	11.18	0.42	10.17	11.00	0.35	10.11	11.07	0.42
Integration of Computers in the Classroom	37.32	40.33	0.33	39.00	40.88	0.23	37.26	38.53	0.13	33.83	42.71	1.00
General School Support for Technology Use	32.63	34.36	0.31	33.27	35.67	0.47	33.14	34.36	0.20	29.82	32.71	0.68
Student Use of Types of Software	35.70	37.50	0.20	37.35	38.25	0.10	34.79	34.65	-0.02	33.77	42.07	0.87
Beliefs about Technology's Value in Education	81.04	79.71	-0.16	82.29	80.13	-0.26	80.76	81.13	0.05	79.00	76.38	-0.37
Teacher Confidence and Comfort with Technology	49.81	50.18	0.05	49.90	50.69	0.12	51.29	51.32	0.00	45.81	47.57	0.25
Teacher Use of Types of Software	38.31	38.38	0.01	39.62	38.13	-0.17	37.92	37.47	-0.05	35.69	39.67	0.47

Sixth-grade Teachers. In general, sixth-grade teachers' responses paralleled those of all teacher respondents, with some scales being a bit more positive and others a bit more negative. Only one effect size difference for a scale was notable: *beliefs about technology's value*. While this scale has an effect size of -.16 for all respondents, it had an effect size of **-.26** for sixth-grade teachers, suggesting their beliefs had eroded more from baseline to final.

Seventh-grade teachers. Once again, seventh-grade teachers' responses closely followed those of the three teacher groups combined. There were, however, two scales that exhibited effect sizes of +.2 or higher for the group of all respondents but did not come close to reaching this level for seventh-grade respondents. Both dealt with reported use. The first, *integration of computers in the classroom*, had an effect size of **+.33** for all respondents, but only **+.13** for seventh-grade teacher respondents. The second, *student use of software*, had an effect size of **+.20** for all respondents, but a negative value for seventh-grade teacher respondents (ES = **-.02**).

Special education teachers. This group of responses differed most from the respondent group as a whole. First, all 10 scales showed effect size changes greater than .2. Second, this group showed larger effect sizes in general, including two effect sizes of 1.00 or greater. Noteworthy scale differences are discussed below.

While all three respondent groups showed negative effect sizes for the *teacher role in student success/make difference* scale, the effect size for special education respondents was half that of the respondent group as a whole (ES = **-.36** versus **-.74**). Similarly, while all respondent groups rated *general school support* higher on the final than the baseline, special education respondents had an effect size more than twice that of the respondent group as a whole (ES = **+.68** versus **+.31**). These respondents also had substantially higher mean ratings on the *integration of computers* scale (ES = **+1.00**, large effect, versus **+.33** for all respondents as a whole and **+.23** for 6th and **+.13** for 7th). This pattern of greater effect for special education respondents continued with their responses to the *student tech skills* scale, where their effect size of **+1.28** was half-again as large as the overall effect size of **+.83** and comparably higher than either other response group).

While the two other respondent groups showed either no change (7th) or changes below the .2 threshold (6th) for the *confidence in using technology* scale, special education respondents displayed significantly increased confidence (ES = **+.25**). Similarly, while the other two respondent groups reported negative baseline-to-final *teacher use of software* means, special education respondents reported significantly greater use (ES = **+.47**).

Lastly, like 6th grade teacher respondents, special education respondents reported significantly lower beliefs in the *value of technology in education* (ES = **-.37**).

Principal Interview Findings

Although principal interviews used a structured form and this same form was used with both principals and assistant principals, the data gathered tend to be more divergent. That is, because of the interactive interview process, respondents sometimes headed in directions that differed slightly from those initially intended by a question. At the same time, such divergence tends to produce a richer data set.

This section discusses baseline interviews first; then reports on midpoint interviews, and lastly discusses final interviews. Within each subsection, the questions discussed are slightly different. These differences further reflect this divergence.

Baseline Interviews

Interview responses cluster around 12 specific questions. Each is discussed below.

Instructional problem. When asked to identify the most serious instructional problem in their schools, principals identified:

- reading (lots of language issues and language barriers)
- trying to keep up with changes (in standards and what students need for life)
- student apathy (with problems outside school and lack of family support acting counter to educational goals)
- teacher inexperience (and the pressures of learning to teach)
- focusing on lower-level learning (because it's easier to do and easier to measure)
- lack of differentiated instruction (because it's harder to plan for and teachers may not know how to do it)

Technology-related problem. When asked to identify the most serious technology-related problem, the principals identified:

- lack of data projectors (to permit teachers to use computers with a whole class for demonstration or instruction)
- lack of wireless AirPorts (so everyone can get online at the same time)
- plagiarism (with kids not knowing which practices are acceptable and which are not and teachers unprepared to confirm authorship)
- teacher anxiety (about how to handle the distribution and recharging of laptops, how to use technology in instruction, and how to teach without allowing technology to be a disruptive force)
- accountability (making sure that teachers are held accountable for the use of technology in meaningful instructional ways)

Technology use in the classroom. As a group, in October the principals reported that if I were to visit the classrooms in their school I would see little technology use. They suggested I might see a number of teachers using the overhead projector. Some suggested I might see the occasional teacher presenting with a projector or TV monitor at the front or perhaps a little use of a computer connected to the Internet. Others suggested I might see some word processing. They discussed the fact that they expected teachers to be using technology much more substantially in the near future. A lot of this seemed to relate to the perception that teachers were not yet

comfortable with technology, particularly computers. As one interviewee said, "A teacher isn't going to do a lot she isn't comfortable with."

Technology as a distraction/classroom management issue. Most respondents did not seem to feel technology would be much of a distraction or the root of classroom management problems. They suggested that when there was a management problem, it was "lids down!" A subset of the respondents suggested that technology was more likely to be a problem for teachers who were less familiar with the technology themselves and thus were more distracted. One cited source of distraction was logistics. That is, figuring out how to recharge the computers, how to keep them secure, and how to handle tech problems. Even among those who suggested technology might be a distraction, they suggested it was a problem that would likely go away shortly—"within a month, I'd hope."

Equipment focus versus instructional needs focus. When asked if the laptop initiative, like many technology initiatives in the schools, had focused more on hardware than on instructional needs, the vast majority of the principals agreed. One respondent reminded me, "The computer doesn't do it; it's a teacher that makes it work." They suggested they "would prefer more balance" in future. They did cite Apple mentor training as helping to move the focus away from hardware on its own, but it was clear that logistic concerns have absorbed much of the school district's energy in rolling out this initiative. In addition, recent changes in staffing were cited as reducing support for meeting instructional needs with technology.

Good use of the Internet in instruction. The principals gave mixed reviews. They suggested that some teachers in some subject areas were making good use of the Internet but, as one principal said, "there's lots of room for improvement." Respondents suggested teachers needed more experience using the Internet and needed to be able to observe students using—and discovering uses for—the Internet before they would see its potential. Some respondents suggested that it was simply a matter of time; having the laptops in place would help to address this.

School district support for teacher use of technology. Respondents suggested that Act 48 credits and B-Flex courses, as well as the district providing each teacher with a computer that he or she can take home at night and in the summer, are marked incentives. Respondents cited the Apple mentor training as an incentive and suggested that the school district in general was quite supportive of teacher use of technology. A single respondent suggested, however, that *incentive* was the wrong word to use. Instead, that person suggested, what should exist is an *expectation*. Thus, all teachers would be expected to use technology in teaching and keeping their jobs would be the incentive.

Teacher preparedness to use technology. This item asked principals to rate teachers as being prepared to use technology one of two levels: *superficial* or *integrated*. At the **superficial** level, teachers would simply be able to operate the hardware and complete basic tasks with the software. At the **integrated** level teachers would be using technology to such an extent that it would be difficult for them to conduct the kinds of lessons they are conducting without technology. Principals rated between 30% and 100% of their middle school teachers as being able to work at the superficial level. When the percentage was less than 100%, the respondents generally cited anxiety and lack of experience as key inhibitors. Respondents generally rated between 30% and 40% of their teachers as working at the integrated level, although a couple of respondents suggested the numbers might be half that large. As one respondent said, "The key is defining what we mean by using technology well. It's more than just hardware. It needs to fit

the curriculum.” As was the case with superficial use, a number of respondents suggested that certain subject areas were more likely to make integrated use than others.

How well sixth-grade teachers prepared. The principals responded that the sixth-grade teachers were quite well prepared in terms of the general mechanics of using the technology. They cited the advantage of the Spring 2004 ramp-up and additional guidance and advice from more experienced Broughal teachers and administrators. They reported, however, that teachers were not as well prepared in terms of curricular integration and might need more support in order to do this well. They did note that sixth-grade teachers were serving as resources for seventh-grade teachers and clearly seemed much more comfortable and better trained than seventh-grade teachers.

Teacher cooperation and support. Respondents cited a number of cases of teachers supporting one another in learning to use technology. As one respondent said, "There's a good atmosphere for sharing." Sharing appeared to happen in team meetings, at faculty meetings, after school, and through B-Flex training. Consistently, respondents suggested that sixth-grade teachers tended to be more collaborative in terms of sharing practices. They hypothesized such sharing may be facilitated by the way in which sixth-grade instructional teams are organized.

Support for technology use. The principals seemed in complete agreement that there was not enough support for technology use. The word *overwhelming* was used by more than one respondent to describe the technological demands of the laptop rollout. They suggested those working to support the initiative were working hard and had the best intentions. The principals, however, were very concerned about logistics and on-site support, as well as whether tech support would have sufficient resources to do the things needed. Several respondents suggested the demands of the rollout meant there was much greater current emphasis on "nuts and bolts" than on curricular integration. They emphasized that integration was going to be much more important in future and this type of support needed to come into place quickly.

Single word reactions to the initiative. Seven of the eight principals were asked to use a single word to describe their reactions to the laptop initiative and explain why. The eighth principal's interview ran long and we did not reach this question. After each of the seven had responded, he or she was asked to identify the single word that teachers would likely used to describe their reaction to the initiative and why. This question was very difficult for the respondents and several took almost a full minute before they could give an answer. In addition, some respondents tried several different words as they tried to evolve their answer aloud. Their responses are detailed in Table 18 on the next page.

Table 18. Single Word Descriptions and Reasons (Baseline)

Principal Word	Why	Teacher Word	Why
Valuable	"It opens a new world of learning." Equalizes access, opportunity, and experience: "Through computers and the Internet, this levels the playing field."	Challenging	Teachers don't have enough time to plan to use it. Using computers in the classroom requires several competencies not all teachers have. Requires teachers to surrender some control.
Paradigm-shifting	"Teachers no longer are warehouses for knowledge but rather conduits to solutions." Parents need to reconceptualize teaching and learning.	More?	Teachers find themselves being asked to be responsible for still another thing. (But after a year they may change the word to <i>tool</i> because it is "helping them accomplish more with students and to do so more engagingly.")
Beneficial	Because it has enhanced everything that goes on in the curriculum, in the classroom, and in the school. Equalizes what can be done by students of all ability levels.	Enhance	Allows us to take from the past what we do well and add new things that enhance learning.
Exciting	"There is so much potential to address students' learning needs with this technology, to create levels of learning, to allow teachers to speed up and slow down instructional skills and lessons in ways that we've never conceived before."	Challenging	"They realize they'll be some accountability in terms of using technology to enhance student learning. This causes a little anxiety: Am I going to be able to use this successfully to show levels of academic achievement?"
Ambitious	"In order to pull off this ambitious task, it'll take a lot of hard work and a lot of buy-in from everyone involved." This is all-inclusive: taxpayers, parents, teachers, students, and administrators.	Neat	This gives teachers more opportunity to extend beyond the old textbook. "It puts teachers on the same playing field with their tech-savvy kids." It offers another teaching option.
Innovative	"It's something that's new and it's a different way to provide students with technology they're going to need to succeed in life."	Exciting/ Adventurous	Provides excitement even though it's challenging. "Good teachers are always looking for ways to reenergize what they do and to bring life to their lessons."
Yahoo!	"Because we finally are evening the playing field for our most needy kids. And the public school system is supposed to offer opportunities to all students."	Challenging	"Change in itself is always challenging. They will see what they can do and challenge themselves to do it. And see how to challenge students."

Midpoint Interviews

Interview responses cluster around 11 specific questions. Each is discussed below.

Instructional problem. When asked to identify the most serious instructional problem in their schools, principals now identified:

- reading for understanding (includes kids with trouble with reading —many who come from ESL background— and those who aren't focusing on the task)
- demands of PSSA testing and standards (standards and testing may limit what is taught and eligible content may or may not be the right things to teach)
- reaching at-risk students (and finding a way to meet their academic needs)
- assessment (need a clear and coherent system of assessment related to instructional practices and individual student needs)
- class management so instruction can take place (problems with transiency, no respect for authority, and lack of support at home)
- lack of differentiated instruction (lack of time and sometimes teacher know-how)

Technology-related problem. When asked to identify the most serious technology-related problem, the principals listed:

- laptop pickup and drop-off/security (always need a place to put laptops and pick them up and need to make sure none of them gets misplaced)
- lack of AirPorts (a few dead spots in the building)
- hardware failures (printers jamming, server going down —“but not enough to impede instruction”)
- planning for failure (how to have enough replacement laptops available exactly when they are needed —“although saving all student files from laptop to server each day is very ingenious”)
- instructional dependence ("People have become very dependent on [laptops] and it becomes an issue when they're not around.")
- inability to take laptops home (Students who have computers at home are using USB flash drives to transfer work from school to home and back; this creates a new version of the Digital Divide.)
- Related Arts left out (Related Arts want a piece of the action, but the laptops are charging while students in their classes, so they are excluded.)
- nothing (logistics are worked out pretty well, teachers are creative and flexible, no vandalism or theft)

Technology use in the classroom. In contrast to their comments in October, most of the principals reported that if I were to visit the classrooms in their school I would see a lot of technology use. "Technology is heavily used. Based on a walk-around last week, I saw 60 to 70% of the teachers using the laptops to some degree. In sixth grade —minus maybe one or two teachers— they are really using laptops a lot and well!" "I think technology is in steady widespread daily usage in both sixth and seventh grade, both by students and teachers." "The teachers are becoming pretty comfortable and finding things that fit in with their content. Lots of teachers are doing things at

a higher level than they could do before." In particular, principals cited frequent use of the *First in Math* program.

Several respondents suggested, however, that technology was not being used quite so widely as they might wish: "It depends on the day. Some teams use technology a lot, but there might be three days when I don't see them use it at all." "About 20% of the classrooms are actively using technology in a big way, while another 40% are using it peripherally or minimally. The remaining 40% have technology available but aren't using it because it's not germane to what is being taught or that person hasn't integrated it yet."

Extent to which laptop initiative has changed teaching. Over half the respondents reported it had made a substantial difference. They used words like *tremendous* and *pervasive* to describe its impact. "Because students are making so much use of laptops, teachers are now using more Internet resources—more authentic resources that go beyond textbooks, resources and scientific artifacts that they would not have used before." "It's made the teacher less of the guru and more a guide/facilitator. They've become a liaison to help kids learn. Very few teachers are having trouble letting go. Instead resistors are converting to become proponents." "It's changed the teachers by making them extend themselves to look for new and engaging ways to use the laptops. It cannot help but improve teaching and engagement of students." Principals reported seeing lots of student technology products (usually Keynote presentations and iMovies) and seeing more student participation and engagement. "Teachers are saying, 'Look at the things I can do to help kids learn at a greater interest level.'" They cited better use of time and time-on-task.

Not all principals were positive, however: "I don't think it's changed it is much as I wanted to but I'm not giving up. I see student using computers, but they don't seem enthralled, but I am seeing that with the teachers." Another respondent cautioned, "It hasn't changed a thing and it's changed everything. Pedagogy is an art; technology is just the next doodad."

Mid-year assessment of tech use improvement. When asked to compare how much better teachers were using technology in February than at the start of the year, the majority of those interviewed reported substantial improvement. "It's the lower-level, less comfortable teachers who made the greatest rise. They are proactive about learning and getting help. Anxiety is down. Initially when the laptops were first rolled out the seventh-grade teachers were particularly stressed out." "The sixth-grade teachers have been using the laptops for longer and it's natural and they use it throughout the day. The seventh grade has more of an open-arms approach. Some are still hesitant in what they do and some failures have demoralized a few of them." "Sixth-grade teachers continue to increase the naturalness of the laptop as part of everything they do. Things are definitely better. The teachers talk to one another, share sites and resources, and are beginning to create lessons with the Internet." Several principals cited sharing among teachers and across grade levels as having enhanced the use of technology in the schools.

One respondent sounded a cautionary note, however: While teachers are doing better and mentor teachers who go off for training, "the laptops are like anything else; training needs to be just-in-time." That person suggested that, if we are to continue to see benefits, training needs to be based on—and driven by—teacher instructional needs.

Exchange and collaboration among principals. Principals were asked if they talked much with their counterparts at the other middle schools about the laptop initiative and if they were able on the basis of those interactions to determine how well their school was doing in relation to the

other schools. It quickly became clear there was little such formal exchange. In fact, most respondents appeared to be reflecting for the first time on possible benefits of such exchange. A common theme is well represented by two statements: "The average is probably the same across schools." and "We are doing as well as anybody." At the same time, the principals exhibited some pride in their middle schools: They often cited some aspect of the laptop initiative in which they thought they were doing at least as well as everybody else—and maybe just a little better. Some respondents cited how well their students were doing in relation to other students, particularly in terms of the competitive auditions for the March school board meeting presentations.

Parent reactions. Principals were asked what sort of reactions they had gotten from parents to the laptop initiative. Few cited specific comments made to them. One noted that parents had made comments ranging from "Why are our tax dollars going to this?!" to "It's about time!" Another principal noted forwarded e-mails originally sent to teachers showed parents praising the techniques being used, particularly with laptops. Yet another noted, "We don't get out to parents enough about the great things going on with the laptops. We should help parents see how they are more than expensive typewriters." The second principal concurred: "We may be missing a chance to show it off to parents." One responded observed, "I think there is general contentment in appreciation of the efforts of those who made it occur. But the parents are watchful how we use them [laptops]; they want to see proper use." One principal suggested that more parents might provide reactions when the Parents Night for Laptops took place.

Teacher preparedness to use technology. While the principals had suggested a mixed level of preparedness in the October baseline survey, they were much more positive in February. Most rated all sixth and seventh-grade teachers as having reached or surpassed the *superficial* level. In terms of the *integrated* level, four respondents rated somewhere between 30 and 50% of their teachers as having reached this level. In general, among this group of principals most rated about 10% more sixth-grade teachers as having reached this level than seventh-grade teachers. The other four respondents suggested that between 75 and 100% of their teachers had reached the *integrated* level, once again with more sixth-grade teachers having reached this level than seventh.

Support for technology use. There was a high degree of unanimity among the principals that what they felt was needed most was support for curriculum integration. Some mentioned the fact that the "nuts and bolts" stuff was now in place and it was time to move to a higher level. "It's one thing to have programs; it's another for teachers to know how to use them." As another respondent said, "We should have someone in our building, part of whose day is dedicated to facilitating curriculum integration." And another suggested a big part of what was needed is more time for teachers to talk with one another about what they're doing and to share.

There was much discussion of going beyond simple generic tool use to get into the details of modifying curriculum to make the most of technology. Two principals addressed the need for such curricular planning to be at the district level: "We need to make sure we're all on the same page and understand; if we know where we need to take the kids, those with power need to create a uniform curriculum to help us get there." "When we write curriculum at the district level, we really need to focus on what kids need in terms of technology skills and technology integration in all subject areas." Related to this appears to be a focus on differentiated instruction: "The key dynamic continues to be the ability to differentiate instruction if we are to get the academic payoff. In-service needs to address the difference curve." Among the types of

training most frequently recommended by the principals was curricular integration using laptops and software, particularly in terms of creating a scope-and-sequence plan across multiple grade levels. Principals cited the need for more modeling of desired instructional practices, suggesting this approach might be most effective with teachers.

Beginning teachers versus experienced teachers. A number of principals commented on the fact that beginning teachers often bring more technological skill to their classrooms. Principals noted, however, that beginning teachers often lack pedagogical strength. In contrast, while many more experienced teachers lack technological skill, many of them have great pedagogical strength. Respondents suggested collaboration between the two groups was producing growth in both sets of teachers. A number of principals noted that one could not generalize to suggest more experienced teachers would be more resistive to adopting and integrating technology into their classrooms. The respondents suggested instead that the key variable was *commitment to teaching*. That is, good teachers are constantly looking for things to enable them to reach their students and help their students learn more effectively. For such committed teachers, the laptop is another powerful tool.

Single word reactions to the initiative. Once again, the principals were asked to use a single word to describe their reactions to the laptop initiative and explain why. After each had responded, he or she was again asked to identify the single word that teachers would likely used to describe their reaction to the initiative and why. As was the case in October, this question proved very difficult for the respondents. Their responses are detailed in Table 19 on the next page.

Table 19. Single Word Descriptions and Reasons (Midpoint)

Principal Word	Why	Teacher Word	Why
Success	"Because I see it working; because I see it being part of what's happening in two-thirds of the classrooms."	6th: "Kool"	The sixth-grade teachers are finding cool things they can be doing with the laptops and they want to show off how neat what the students are doing is.
		7th: Juggling	Seventh-grade teachers have lots of mechanical issues, but it's getting better and they are adding integration to all the things they juggle now.
Impressed	"It's had impact on learning for teachers and students and they're working together, with the students feeling empowered in many more ways than I expected."	Relieved	"It's been so much more positive (by a factor of 10) than they feared. The logistical issues are less a problem than expected. There is so much upside on the laptops in terms of academic/instructional payoff."
Aggressive	"Because administratively the district has taken a stand on looking at what kids need 5, 10, 15 years from now. Growth has been at times at warp speed. The district has taken an aggressive stand: this is what is right for our kids."	Necessary (Sustainable?)	Because the teachers have become so comfortable in using technology, they now need to have the laptops to teach in the new ways they have developed. But the questions are, Can we sustain this? Will the school board support this?
Eager to learn	"I look for learning opportunities for me and my teachers."	8th: Anticipation	Some fear and worry: Will we be ready? Can we keep up with our colleagues?
Super	The laptop is taking learners, particularly lower-level learners, to the next level. It allows the gifted to go faster. Students at all levels get pushed.	6th: Part of the Daily Routine	Sixth-grade teachers integrate this throughout everything they do; it's part of every day.
		7th: Experimental	Seventh-grade teachers are more anxious about what they can or should do. They are actually letting go of control and learning to try more things.
Progressive	There are people listening to student needs and concerns and teachers are starting to see the value of the laptops.	Working	Teachers are seeing how they can use them to improve instruction and are trying a variety of things, but cautiously.
Challenging	Because so much goes into making it successful. Important to determine what teachers need to help them make it work and what students need to do well. Important to inform the parents and community.	Exciting	Teachers are doing new things in the class. The teachers are learning new things as well as the kids and there's excitement attached to getting your own laptop, whether you are a teacher or student.
Important	"Each kid's future is dependent on what we do and if we have our foot in last year's thinking, our students will fall behind."	Meaningful	Teachers will latch onto the laptop as a way to enable them to do things better.

Final Interviews

Interview responses cluster around 13 questions. Each is discussed below.

Assessing success of initiative. When asked to assess whether the initiative was a success and why or why not, the principals were unanimous in judging it a success. They listed as support for their conclusions:

- Teachers becoming more successful in using technology to enrich their presentation/lessons.
- Students and teachers are exhibiting more of a collegial approach in instruction and learning, learning from one another and sharing expertise. “Sometimes the kids are the wizards, not the teachers.”
- “It’s the equalizer, it puts every kid on the same level. ... It lends a lot of choice and self-efficacy –reaffirming students’ individual worth as kids.”
- Students going more deeply into research, manipulating data, using information to explain what they see.
- “It has augmented opportunities for teachers and kids, primarily for our C-track –low achieving kids– to log onto instructional sites to make most of time and small openings (better and more use of available time).”
- It has enhanced writing and spelling through word processing (enhanced legibility).

Financial value of laptops. Principals were asked to put a dollar amount on the value to each individual student of having a laptop computer for the entire year. This question was a challenge for them. Three of the five classified its value differently according to the user or use, suggesting a range of value. The responses of the five respondents who were able to assign a dollar figure:

- \$250 - \$500. “Worth more to students who do not have access in other ways.”
- \$800 - \$1000. “Special needs benefit greatly – handwriting, revision, spell check, visual learning. ESL and learning supports benefit a bit more, but all benefit.”
- \$900 - \$1200. “I think it has had much more impact on reading comprehension and purposes of writing. It is at least as powerful as any SAT prep course and is much more valuable. And this time good for both highest and lowest skill levels, but lowest may be getting greatest benefit. Reading and writing for purpose benefits most.”
- \$1200. “It’s like an IEP. It meets their needs to the extent they need. Depends on their needs. It’s a friend to some degree because you interact individually and can tailor it to your preferences. Becomes an extension of user. Some standardization.”
- \$3333. (“About \$100,000 /classroom – divided by 30.”) “Differentiated value by academic level: Special accommodations invaluable and Special Ed and at-risk learners’ laptops are worth much more.”

The per-student average for these five principals was \$1297 for the lower end of the range and \$1487 for the higher, or a mean range of around \$1300 to \$1500 per student.

The other three principals did not provide dollar figures. Two of them, however, suggested that the per-student value was based on what teachers have students do with laptops:

- “Cannot put a value on the life skills they are learning. Building foundation for later skills. Definitely worth the cost. Easiest thing is to say it is priceless, but its value depends on the teachers the kids have.”
- “Value is based on what we are doing with them.”

Biggest payoff for the time invested. Principals were asked how exactly teaching and learning were better because students had laptops. Among the benefits they cited:

- Teachers doing better planning, extending and refining previous lessons to use technology effectively. Teachers have also had to do more themselves [to keep up with the technology use of kids].
- Better time management for both teachers and students. More hands-on, more time-on-task.
- Students seeing why they need to read and write for purpose. Greater contextualization of skills because they got hooked on how to design persuasive presentation.
- Payoffs are curriculum-specific. *Language Arts*: Improving writing process and facilitating revising. *Math*: Helping them find enjoyable ways to learn basic facts and keep fresh in mind. *Science and SS*: Brings those subject to life in ways textbooks cannot.
- There is more engagement of staff and students and enthusiasm about learning.
- Accessibility to outside informational resources.
- More creativity in presentations and assignments. More real-world products than in past. Building blocks for what they are going to be seeing in possible careers for themselves.
- Staff development by the district is greatest benefit.

Changed views. Principals were asked if the laptop initiative changed anything about how the students view themselves or their school. Respondents cited enhanced pride in work and increased motivation. One principal referred to the initiative as a “great equalizer,” while another noted that the students in his/her school now believe themselves “equal to others in district” [in contrast with a former perception of themselves as second-class]. Yet another principal suggested the laptop initiative had created an enhanced sense of control for students who no longer view teachers as “the center of knowledge universe.”

6th grade and 7th grade teacher differences. When asked to talk about how these two groups of teachers differ in their use of technology, most principals suggested differences between grade-level teachers existed earlier in the year, but had been largely eliminated by the end of the year. They cited district training and collaboration among teachers as helping to eliminate these differences.

Respondents suggested that the greater differences might be between younger and older teachers, with younger teachers more comfortable with technology and older teachers more experienced with teaching. Other respondents suggested the differences were “more subject-specific than grade specific.” They suggested use might be easier for 6th grade teachers because

they all teach some writing and reading and hypothesized it might be easier to see the connection between technology applications and science and social studies.

Special education use of laptops. When asked to talk about how special education teachers used laptops with their students, all principals suggested these teachers made extensive use of the laptops, often in the very same ways as regular classroom teachers. Some respondents suggested special education teachers were excited by the new possibilities technology offered and had become increasingly positive as the year went on.

Teacher preparedness to use technology. On the final assessment, the principals rated most sixth and seventh-grade teachers as having reached or surpassed the *superficial* level. While three principals suggested between 90% and 100% of their teachers had reached this level of proficiency, several principals suggested this figure might be closer to 65% to 80% for the seventh-grade teachers in their buildings.

In terms of the *integrated* level, two respondents suggested 20% of their teachers perform at this level, while another suggested 20% to 30% of teachers, and another rated only 10% at this level. A fifth principal suggested that 60% of his/her teachers were operating at this high level. In all five cases, the principal made no distinction between 6th and 7th grade teachers' performance. The remaining three principals, however, suggested there was a difference between 6th and 7th grade teachers' integration of technology into teaching, with between 10% and 20% more 6th grade teachers performing at the *integrated* level than 7th grade teachers.

Enhancing support for student use of laptops. Principals were asked to identify ways to enhance the use of laptops in their schools. They made a number of specific suggestions:

- Strengthen support for tech integration: Throughout the year every other week allocate time for content teachers to meet with an integration specialist. An integration specialist should be available on first days of implementation (key period for support in order to reduce fear). Provide each school with an in-building person whose sole job would be to work with teachers and students as a specialist in integration of computers. That person would also do in-services with teachers after school and at other times.
- Employ a person to help train teachers to differentiate instruction through laptops. Give someone release time across disciplines to help teachers design lessons using laptops, enhance assessment, and design model lessons.
- Have as much staff development as possible: Provide more teacher training on site. Contextualize learning –transfer from training to implementation– including modeling, observation, and feedback, videotape best practices or allow cross-classroom/cross-school visits (to enhance student achievement).
- Have the curriculum-based person at district level make more frequent follow-ups and observations.
- Encourage more team planning and collaboration in technology use: Provide subs to cover staff development by department or by team. Teachers have a better chance to succeed by team and this would force them to act like a team. Envision the entire district as a team, not just grade-level teams or school teams.

- Give every teacher more planning time to plan for using/improving technology during the school year, not just summer. Provide time to experiment with technology. Maybe even provide subs to permit teachers time to plan. To make part of fabric at the building level, not at the district level.
- Enhance tech support and responsiveness: Provide more on-site tech support. Augment the one fulltime tech person with a couple of teacher aide people would help that person. Provide one tech support person per grade level.
- Enhance available instructional equipment: Put a data projector in every classroom along with a TV monitor. Provide one digital video camera and one or two nice digital still cameras for each team. Every teacher should have DVD burner in his/her laptop. Add more server space or extra servers to handle ever-increasing load.
- Provide schools with a (staffed?) production lab (with additional equipment and software) to integrate music, visuals, and the like.
- Enhance security without making the individual buildings create their own procedures. Instead, create standardized district-wide procedures and consistent and secure building-level storage facilities.
- Establish better lines of communication between building-based tech people and IT center.
- Use a pre-school survey to identify most pressing needs and allocate resources based on identified needs and their priority to teachers. Resurvey in December to identify new needs and changed priorities.

Continuing the laptop initiative. Principals were unanimous about the district continuing the laptop initiative. In their endorsement of continuing, some cited how the initiative places the district in the educational forefront: “Bethlehem has always been at the forefront of educational leadership. Dr. Lewis is pushing the envelope. I’m extremely proud to be part of this. I brag about it a lot. It’s more risk. It’s more work. But it’s worth it. It’s part of the way we do things now. Dr. Lewis has vision –like [offering] wireless access district-wide.”

But several principals replied, “Yes, with caveats” and went on to suggest things that might be improved in future. Among the possible improvements they suggested:

- Focus more on differentiating instruction. Until we do a good job on that, perhaps not move beyond laptops in the middle school.
- Facilitate collaboration among students and classes across the middle schools within the district, perhaps in science. This might require obtaining online collaborative software to facilitate such interaction.
- Either allow students to take computers home or buy team sets of computers. Teams in meetings would schedule use among members. This allows you to limit hardware purchase and use money instead for staff development and a curriculum integration person in each building.
- Work to improve logistics (storage, transport, charging, security) because problems here can lead to lost instructional time: “30 minutes lost each day to logistics: 90 hours per year, 4.5 hours per day, in lost core academics. Waste 20 days of learning to logistics. Bothers me. I squeeze blood out of rocks to get time for teachers to work with students.”

Concerns about 8th grade teachers' preparedness. When asked to assess how prepared 8th grade teachers were to participate in the laptop initiative next year, the principals suggested they felt the teachers were largely “braced.” That is, 8th grade teachers appear to be about where the 7th grade teachers were at the start of this year: ready, but a bit anxious.

When asked what might be done to help get 8th grade teachers better prepared to succeed next year, the principals suggested the key would likely be to expand the mentoring program. This entailed more mentors, more time, and strong summer training. They cited the need to facilitate exchange of practices and “tech tips” among 6th, 7th, and 8th grade teachers. Another key appears to be making sure that 8th grade teachers get strong support, modeling, and feedback early in the fall implementation. Several principals suggested this was a problem this year for seventh-grade teachers and that a fast start next school year could make a difference.

One principal expressed concern about obtaining 8th grade mentors: “The time we are asking is a lot for these mentors. Not all mutually convenient time. Hard to get people to dedicate. May lead to an awkward transition. District needs to try to stipend for extra services/roles. Mentor teacher doesn't get rewarded enough; Act 48 credit and flex time not enough. Building the reward into their contracts would be better because could tell them to do [as opposed to relying on volunteer efforts].”

Impact of discontinuing the initiative. When asked to assess how discontinuing the laptop initiative would affect teaching and learning in their schools, the principals identified three major negative effects: *reversion to less dynamic teaching practices, teacher and student demoralization, and increased inequity.*

Many principals hypothesized that what they perceive as gains in planning, creativity, and enhanced teaching practice would be lost: “We'd begin to see more traditional *I'm the expert / sage-on-stage* approach. Become dependent on believing everything coming from teachers is accurate. It would reduce access to outside rich resources. Laptops diversify knowledge and authority.” “We'd lose the community of learners and the purposefulness fostered by using presentations.” “We could still teach. We'd just use computers in smaller ways and the quality of what we could do with kids would go down.” One principal noted that laptops have enabled teachers to squeeze extra laptop-facilitated learning activities (like *First in Math*) into any few minutes of class that might have been wasted before.

In addition, many suggested morale would be damaged: “There would be disappointed people – kids for sure. Students would have more difficulty with loss.” “It would hurt morale because it was not given enough time to see if it worked or not.” “It would be a slap in the face to professionals to give you wonderful tools and put you through all this training [and then just stop].”

Two principals noted having laptops helps to equalize educational opportunity: “The advantage of having a computer at school for economically deprived is crucial, so the loss there would be severe.” “Laptops equalize the resources and opportunities of teachers. If lost, this would ‘un-level’ the playing field.”

Parent reactions if initiative discontinued. Principals were asked to assess how the parents of their school's students would react if the laptop initiative were discontinued. Several suggested some parents would be upset: “Parents who are advocates of students would hate to see their student lose the opportunity they cannot get any other way.” “[Parents would be] stunned. Only did two years and discontinued without given time? Why begin in first place if did not have

funding to continue? Parents without computers at home would feel deprived after last two classes getting them.” “Some would be ready to mobilize and create a racket. Driven mostly by what best for kids. Some would say: Education does this crap all the time; fads come and go. It’s not about what is best for kids.”

The principals hypothesized other parents would be either neutral or relieved: “Parents often do not know what their kids are doing with laptops.” “One faction would say, ‘Oh reducing taxes, better for me’ (less out of my pocket). Another group would put teachers under a microscope: How are you accommodating my kid since the laptops are not there anymore?” “Some [parents] would say, What difference does it make since kids couldn’t take laptops home?”

Single word reactions to the initiative. Once again, the principals were asked to use a single word to describe their reactions to the laptop initiative and explain why. After each had responded, he or she was again asked to identify the single word that teachers would likely used to describe their reaction to the initiative and why. As was the case in both October and February, this question challenged respondents. Their responses are detailed in Table 20 on the next page.

Table 20. Single Word Descriptions and Reasons (Final)

Principal Word	Why	Teacher Word	Why
Kinetic	There is so much potential energy that is stored and could be converted to excitement and learning outcomes.	6th: Improving	Sixth-grade teachers now have one year under their belt. They have become more comfortable and are now looking for ways to incorporate and integrate more.
		7th: Policies	7 th grade teachers wanted written tech-use policies and 'black-and-white' rules.
Adventure	"[We were] starting out with something few districts or schools had used. [So you] go with ups and downs, good and bad, and discover as you go along."	Challenging	The instructional level needs to challenge, to go beyond what done in past. We have logistics challenges. We are challenged to help students meet academic standards and standards for tech skills.
Energizing	"It's changed in many ways our outlooks as teachers when we think about our careers and what do for kids. We are part of getting this future generation into the right mindset."	Fantastic	It has changed teaching and reflection on teaching for both veteran and new teachers. "When you are teaching you fall back on believing teaching is your job and is enough –as opposed to <i>learning</i> being the key." This initiative has caused us to focus more on what we are learning and why.
Potential	"There's still a great deal of potential for further impact for kids we have yet to tap."	Positive	It had an overall positive impact on the learning climate and learning community.
Ambitious and Progressive	"Because it's trend-setting. Look across country; only a handful of districts are doing this. It takes an ambitious and challenging school system (board, superintendent, principals, etc.). It takes a lot of nerve to withstand taxpayer pressure and scrutiny."	Thankful	Because the district offered a chance to try an innovative approach to meet the challenge of addressing student interests and needs with tech.
Exciting	"Because enthusiasm is there from students. Enthusiasm is there from teachers. Together they take average and run-of-the-mill and make it more. Kids are driven to go higher, do more, do better."	6th: Routine	For sixth grade, laptops have become part of the classroom and are starting to replace the textbook.
		7th: Challenging and Promising	Seventh had a learning year, with tech problems and kids not being quite as tech-savvy as teachers expected. Teachers saw light at end of tunnel near end of year and are now seeing potential and value.
Gratitude	"I'm grateful taxpayers have supported this. The school board had vision and required us to demonstrate instructional sound use of laptops. I'm grateful to teachers and support staff and to Apple for it's dedication."	Routine/Integral	The laptops are part of everything we think of and do. Schemata are built on tech now and are a part that cannot be separated. "Adding laptops has removed the barriers and we can now use tech spontaneously."
Life-changing	"Because it promotes positive change and perspective."	Meaningful to Disastrous (Depends)	"Everyone knows it's here to stay. Even if had had no computers/laptops, still need to incorporate [tech in instruction]."

Discussion and Interpretation

The interim report suggested sixth-grade teachers, who had more prior exposure to using laptops, were making greater headway at integrating technology into everyday instruction. That report opined, "If we may extrapolate from the performance of the sixth-grade teachers, it seems likely that seventh-grade teachers will be in about the same position by the start of school next fall that the sixth-grade teachers were in February." The final survey data suggest this may be the case. Differences among sixth and seventh-grade teacher responses were less marked than at either baseline or midpoint. At the same time, principal ratings of technology skills of sixth and seventh-grade teachers certainly suggest some schools may have seventh-grade teachers that have less technology skill and who use technology less than those schools' sixth-grade teachers. In addition, seventh-grade respondents' reported levels of their own use of computers and computer use by their students were markedly lower on the final survey than the other two respondent groups. Further, principals expressed some concern that eighth-grade teachers may find themselves this fall in a similar position to this year's seventh-grade teachers, thus placing more demand on the support resources available to help teachers develop skill with technology and expand its use in their classrooms.

Teachers attributed much of their newly acquired technology expertise to in-service sessions and workshops. This suggests technology-related professional development may be having the desired result. Sixth, seventh, and affiliated special education teacher respondents all rated the desirability of basics training lower at final than earlier. This suggests a need for more advanced training and the district may wish to look at the results of the teacher survey to identify which types of training now have higher ratings. At the same time, in light of the principals' concern about 8th grade teachers' needs, the district will likely need to offer such advanced training in addition to the already existing program of training in the basics.

The final survey data support the interim report's conclusion that tech support currently met teachers' perceived needs. Although principals cited a variety of minor glitches and logistic problems in all three sets of interviews, the teachers almost universally seem pleased with both the level of support they receive and the responsiveness of those who supply it. Given the size of this initiative and the demands it places on a school district, this is certainly something to which the district may point with pride. That teachers and principals now want to move further and get deeper into curricular applications and integration is a favorable sign.

Late in the school year, a number of laptops were stolen from one school. Principals had been worried about this possibility for some time, a concern I heard repeatedly in interviews throughout the year. Final interview responses emphasized the desire for enhanced security for the coming year by standardizing district security procedures, rather than asking individual schools to create their own procedures.

Special education teachers appear to have embraced this initiative. They showed significantly more favorable reactions across a wide range of items on both midpoint and final survey and rated their students as working more independently on the midpoint than the baseline and on the final than on the midpoint. Analysis of baseline-to-final changes show the greatest changes among all teachers surveyed, changes that suggest special education teachers are using technology, their students are using technology, and both special education teachers and students are growing in confidence and independence. As the interim report stated, "While there is much discussion in the literature about how technology can help special populations, in many cases

such help is limited by the amount of technology available to them. Bethlehem Area School District's implementation of the laptop initiative may help remove that limitation. If the special education teachers are correct in their assessment that students are able to perform more tasks independently without teacher help, this offers the possibility of providing a kind of 'intellectual robotics' that enables the staff of special education teachers to do more with technology than they would be able to do without it."

Anecdotal reports derived from the principal interviews suggest students may be more engaged by their laptop-enriched learning experiences. Several principals also suggest that each student having a laptop may be enabling teachers to do some basic differentiated instruction, mostly through pacing and individualized materials. Principal comments suggest support for curricular integration continues to be the most pressing need in the school district. They suggest the greatest potential of the technology may be in differentiating instruction to address the needs of a much wider range of students than most teachers are currently able to address. In fact, in final interviews, some principals even suggested the district might consider moving from individual laptops to class sets, freeing previously committed funds for use in enhancing professional development for curricular integration and differentiated instruction.

The finding that by the end of the year teachers felt less positive they were able to make a difference than they did at the start of the year is not necessarily a surprising finding. Teachers get worn down across a school year and the final survey occurred in May. At least the data suggest respondents were again becoming more positive in May than they were in February in the depths of winter. This finding may suggest there is presently little relationship between the laptop initiative and solving some of the more challenging educational and behavioral problems of students. It may also lend support to the principals' contention that more focus on using computers to differentiate instruction would benefit teachers and students.

In any school district, at least some portion of the population will likely leave school prior to graduation from high school. The interim report stated, "It will be interesting to see if students' ratings of their own technology abilities go up significantly on the posttest measure later this spring." Those ratings did indeed go up and students now view themselves as even more capable than "typical" students. If teacher and student assessments of student independence using technology are accurate, this initiative appears to be producing what are termed *21st Century Technology Skills* in middle school students. This should enhance their real-world employment opportunities, regardless of how much farther they go in the system.

As the interim report noted, "One of the more interesting things about this initiative is the sense to which it appears to have engendered pride in the participants. Another way in which pride seemed to come into play was in how the principals talked about their students and teachers in comparison to those in other middle schools. While no principal denigrated a colleague's school, all spoke of their own schools with great pride and appeared to see the way in which their teachers had embraced, or were embracing, the laptop initiative as a component of such pride." This pride in one's school was evident again in final interviews, but it is worth noting that principals are beginning now to express an interest in creating more cross-school sharing and collaboration.

Clearly, an initiative like this one is expensive. It is interesting to note the various dollar figures principals placed on the worth of each student having a laptop. Most principals suggested having a laptop was of greater value to some students, for some subjects, and when

used by certain kinds of teachers. Should the district have to reduce the scope of the laptop initiative in future, this fact may offer a starting point for hard decisions. For instance, exactly which students benefit the most and why? Which subjects lend themselves most to academic enhancement through use of laptops? And what are the characteristics of teachers who make the most effective use of laptops with their students?

When principals were specifically asked to judge whether the laptop initiative was a success or not, they unanimously rated it as a success, although they noted ways in which its implementation might be improved in future. As one of the principals noted in the midpoint interviews, it is not technology that makes the difference; it is solid pedagogy. Thus, while having laptops may enhance instructional opportunity, it cannot, in and of itself, enhance academic achievement. The principals suggested, however, that discontinuing the initiative would have negative effects on instructional practice and morale, as well as act to reinstate some of the educational inequities that apparently existed before the initiative was implemented. Several principals also suggested at least some segment of the parent population would be disturbed, perhaps because of lost opportunities for their children, perhaps because a school laptop represents almost the only way their children can gain access to such technology, or perhaps because the district expended large numbers of resources without giving the initiative time to produce educational results or because the district failed to collect data to document academic gains.

This latter point seems important. The present evaluation, while it collected a rich set of data over a nine-month period, did not gather data on academic achievement that could be linked in any meaningful way to the laptop initiative. In fact, it does not appear that the district currently collects or breaks out data at a level easily amenable to analysis for this purpose. As the interim report noted, the district would need to collect longitudinal data to determine if implementation of the laptop initiative has had a significant positive influence on academic achievement. That report also cautioned, however, that “both research studies and literature in the field are clear on one point, however: It usually takes three to five years to see marked changes in academic achievement across most populations of students.” But, in order for the district to begin the process of measuring academic impact, it must establish a clearly defined academic baseline, using measures conceptually and operationally linked to use of laptops in the schools. This, then, appears to be the district’s next logical step in determining the true impact of the laptop initiative on teaching and learning.

**For further information regarding this evaluation,
please contact:**

Ward Mitchell Cates, Ed.D.

External Evaluation Director: BASD Laptop Project

111 Research Drive, Lehigh University

Bethlehem, PA 18034

wcates@smarter-by-design.com