Evaluation of a Laptop Program: Successes and Recommendations

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Introduction

The overall purpose of this evaluation study was to determine the effectiveness of providing 5th and 6th grade students in Walled Lake Consolidated Schools (WLCS) with access to laptop computers with regard to classroom learning activities, technology usage, and writing achievement.

The WLCS Laptop Program is based on the Anytime Anywhere Learning (AAL) program (AAL, 2000), which has been in schools since 1996 and has impacted more than 100,000 students and teachers. The goal of the AAL program is to provide students the knowledge, skills and tools to learn anytime and anywhere.

The Laptop Program arranged to have laptop computers available for a monthly lease fee of fifty dollars. The Laptop classrooms were equipped with wireless access to the Internet and printers. The program also provided students and parents the opportunity to receive training on basic computer skills. The Laptop teachers received ten full days of professional development prior to the 1999-2000 academic year and six one-half day sessions during the year. The training was based on the NTeQ model (Morrison, Lowther, & DeMuelle, 1999) which provides teachers a framework to develop problem-based lessons that utilize real-world resources, student collaboration, and the use of computer tools to reach solutions. The lessons are typically structured around projects, which engage the students in critically examining community and global issues, while strengthening student research and writing skills.

Research Questions

The evaluation of the Laptop Program was structured around three primary research questions that focused on classroom practices, student behavior and writing ability. The detailed questions are listed below:

- Is teaching different in a Laptop classroom? To answer this question, observers examined classroom practices to determine if instructional practices in Laptop classrooms were different from those in non-Laptop classes. For example, were classrooms lecture-based and/or project-based, were the classrooms academically focused and were students engaged, did teacher questions call for students to construct responses or simply recall factual information.

- Do students behave differently in a Laptop classroom? By observing and talking to students, observers gauged the level of interest in learning, student attitude toward one another (do they get along and are they helpful), and the degree to which students take initiative for their learning as opposed to being dependent on the teacher for constant direction.

- Do students achieve differently in a Laptop classroom? Observers assessed writing samples from Laptop and non-Laptop classrooms looking for both content and quality, observed whether writing in the classroom was sustained or short-term question and answer, and whether technology was used as a tool to increase the quality of work or simply for computer assisted instruction.

Design

The evaluation period extended from September 1, 1999 through May 30, 2000. The evaluation design was based on both quantitative and qualitative data collected from students, teachers, and parents involved with the Laptop Program and students and teachers in non-Laptop classrooms in seven schools (four elementary and three middle) within WLCS. Comparative analyses were completed for teaching activities and learning outcomes and descriptive analyses were completed for student, teacher, and parent reactions to the Laptop Program.

The data set for the evaluation included classroom observations, student writing test scores, student surveys and focus groups, teacher surveys and interviews, and parent surveys and interviews. Two separate observation measures were used to collect observation data: The *School Observation Measure* (*SOM*[′]), and the *Survey of Computer Use* (*SCU*). *SOM*[′] was based on 60 continuous minutes of observation, divided into about 4, 15-minute segments. These 4 observation periods were then summarized on one *SOM*[′] Data Summary form. *SCU* was completed as part of the 60-minute observation sessions, only if students used technology during that time. A total of 50 classroom observations were conducted, with 32 in Laptop classrooms and 18 in non-Laptop classrooms.

The WLCS's *Writing Scoring Guide* was used to assess prompted writing samples from Laptop and non-Laptop students. A sample of 32 Laptop and 32 non-Laptop students were randomly selected to complete the writing test. Experienced reviewers used the district's four-point rubric (ranging from 1 to 4, with 4 being the highest rating possible) to conduct a blind assessment of the writing samples for Ideas and Content, Organization and Form, Style, and Conventions, yielding four scores per student.

The student, teacher, and parent surveys, interviews, and focus groups primarily focused on three areas: have the laptop computers had a personal impact (increased skills – research, computer, learning), have the laptops impacted what happens in the classroom, and what are the benefits, difficulties, and ways to improve the program. The final data set includes: 397 student surveys, 58 student participants in focus groups, 13 teacher surveys, 7 teacher interviews, 187 parent surveys, and 40 parent interviews.

Results

Classroom Observations

SOM©—As indicated in the description of SOM©, the observation procedure focused on 24 instructional strategies using a five-point rubric (0 = not observed, 1 = rarely, 2 = occasionally, 3 = frequently, and 4 = extensively). Two additional items use a three-point scale (1 = low, 2 = moderate, 3 = high) to rate the degree to which academically-focused class time and student attention/interest/engagement are evidenced. In an initial analysis of the SOM© data, rubric

categories 2-4 were collapsed into one category to yield a two-category scheme reflecting the percentage of visits in which a strategy was either observed or not observed. As seen in Table 1, the analysis revealed significant differences, which favored Laptop over the Control teachers on project-based learning (65% observed vs. 22%), independent inquiry/research (58% vs. 24%) computer for instructional delivery (22% vs. 0%), and computer as a learning tool (88% vs. 17%). In general, strategies promoting learner activity, such as cooperative learning, inquiry, sustained writing, and computer uses were more likely to be observed in Laptop classrooms.

Table 1: Proportion of times an event was observed (1-4) versus not observed (0)

	Laptop		Control	
Strategies	Observed	Not observed	Observed	Not observed
Direct instruction	68.8	31.3	77.8	22.2
Team teaching	15.6	84.4	11.1	88.9
Cooperative learning	65.6	34.4	38.9	61.1
Individual tutoring	13.3	86.7	11.1	88.9
Ability groups	0.0	100.0	0.0	100.0
Multi-age grouping	0.0	100.0	0.0	100.0
Work centers	3.1	96.9	11.1	88.9
Higher level instructional feedback	61.3	38.7	38.9	61.1
Integration of subject areas	21.9	78.1	5.6	94.4
Project-based learning**	64.5	35.5	22.2	77.8
Use of higher-level questioning	56.3	43.8	50.0	50.0
Teacher as facilitator	71.9	28.1	61.1	38.9
Parent/community involvement	0.0	100.0	5.6	94.4
Independent seatwork	71.9	28.1	55.6	44.4
Hands-on learning	19.4	80.6	16.7	83.3
Systematic individual instruction	0.0	100.0	5.9	94.1
Sustained writing/composition	53.1	46.9	38.9	61.1
Sustained reading	28.1	71.9	38.9	61.1
Independent inquiry/research*	58.1	41.9	23.5	76.5
Student discussion	50.0	50.0	44.4	55.6
Computer for instructional delivery*	21.9	78.1	0.0	100.0
Computer as a tool**	87.5	12.5	16.7	83.3
Performance assessment	37.5	62.5	22.2	77.8
Student self-assessment	18.8	81.3	16.7	83.3

*$p < .05$; **$p < .01$; ***$p < .001$

There were seven comparisons that yielded statistically significant differences from *t*-tests comparing the means for Laptop and Control classes on each SOM' item, all of which had associated effects sizes of .59 or higher in absolute value (see Table 2). All of the significant differences favored the Laptop classes: computer as a learning tool (*ES* = +2.29), project-based learning (*ES* = +0.95), independent inquiry (*ES* = +0.89), higher-level instructional feedback (*ES* = +0.61), teacher as facilitator (*ES* = +0.64), cooperative learning (*ES* = +0.59), and computer for instructional delivery (*ES* = +0.59).

Table 2: A Summary of Items Showing Significant Differences Between Laptop and Control Group Comparisons on the SOM©*

	Laptop		Control				
Items Using Rating Scale A**	*M*	*SD*	*M*	*SD*	*t*	*p*	*ES*
Computer used as a tool	2.84	1.43	.16	.38	7.71	.000	2.29
Project-based learning	2.25	1.84	.66	1.32	3.21	.002	0.95
Independent Inquiry	1.90	1.81	.52	1.12	2.83	.007	0.89
Higher-level instructional feedback	1.64	1.53	.77	1.16	2.07	.044	0.61
Teacher as facilitator	2.40	1.70	1.38	1.37	2.17	.035	0.64
Cooperative learning	1.71	1.50	.88	1.18	2.01	.050	0.59
Computer for instructional delivery	.65	1.35	.00	.00	2.04	.047	0.59

*Sorted by Effect Size

**Rating Scale A
0 = Not Observed
1 = Rarely Observed
2 = Occasionally Observed
3 = Frequently Observed
4 = Extensively Observed

SCU—Laptop classes, as would be expected, contained more computers ($p < .001$) than did Control classes. Additional areas where significant differences occurred were that Laptop classes had more: (a) PC's, (b) up-to-date computers, (c) Internet access, (d) printer access, (e) color printer access, (f) computers clustered together, and (g) computers that were distributed. Further, Laptop classes always had at least one student at one computer and rarely had more. By comparison, about half of the Control classes averaged one student per computer, while half had more than five students per computer. All three comparisons involving the availability of computers to students significantly favored the Laptop classes. With regard to student technology skills, Laptop students were rated significantly higher than were Control students on computer skills ($p < .001$), keyboarding skills ($p < .001$), and mouse skills ($p < .01$).

Comparisons of observation means using *t*-tests revealed statistically significant differences, most of which are noted above, and collectively show that Laptop classes provided greater access to computers and associated peripheral equipment to develop higher skill levels by students, to engage students and teachers more extensively in computer applications, to use computers more for research and for production in writing and design, and to make greater use of word-processing and Internet software (see Table 3). Importantly, on the final rubric, Laptop classes were rated as making much more meaningful use of computers compared to Control classes (*M*'s = 3.18 vs. 1.00, *ES* = +2.72).

Table 9: Computer Impact

Group		Not Observed	Rarely	Occasionally	Frequently	Extensively
Laptop	Computer (s) worked well***	4.0%	0.0%	0.0%	8.0%	88.0%
	Students were very engaged in computer activities***	8.3%	8.3%	0.0%	20.8%	62.5%
	Teacher provided technical coaching**	18.2%	13.6%	4.5%	13.6%	50.0%
Control	Computer (s) worked well***	83.3%	0.0%	0.0%	8.3%	8.3%
	Students were very engaged in computer activities***	83.3%	0.0%	0.0%	16.7%	0.0%
	Teacher provided technical coaching**	81.8%	0.0%	0.0%	18.2%	0.0%

*$p < .05$, **$p < .001$, ***$p < .001$

Writing Performance

Writing Scores. Students in Laptop (n = 32) and Control (n = 32) classes were asked to write a prompted essay. The essays were then scored in the blind on a rubric encompassing the four dimensions of Organization, Idea, Style, and Conventions. For each dimension, the essay was scored from 1 to 4, with 4 being the highest rating possible.

Mean performance scores for Laptop and Control students were analyzed via a one-way multivariate analysis of variance (MANOVA) with the four dimension scores serving as the dependent variables. The MANOVA yielded a significant program effect (p = .048), therefore, univariate analysis of variance (ANOVA) was performed separately on each dimension. All four tests were highly significant and indicative of higher performance by Laptop than Control students. Effect sizes ranged from +0.61 to +0.78, suggesting moderately strong and educationally important effects.

Student Reactions

Student Survey. The Laptop student survey responses (n = 397), indicated that students felt their computer skills had increased, and they were better able to do Internet research. They were less certain that using computers at school increased their interest in learning, made them want to get better grades, improved their writing, or made it easier for them to work with other students. Over half of the students reported fairly regular use of the laptop and the Internet for completing homework, while even more reported uses for “other things.” The two most frequently cited “other things” were e-mail/chat and games.e-mail.

When students were asked to describe the best thing about having a laptop, students included that it helped them learn computer skills, helped with school assignments, provided access to the Internet, and it helped the students become more organized. When students were asked about the hardest part of having the laptop, there was general consensus that it was difficult to keep track of and carry back and forth to school. Other concerns included reoccurring technical problems (e.g., freezes, charging, slow), using Microsoft Access, and students lacking sufficient computer skills. Overall, the survey results show that Laptop students were highly appreciative of having laptop computers and were taking advantage of its resources for performing a variety of learning activities

both at school and at home. Students were more likely to experience benefits of the laptop activities for the development of specific technology skills than for increasing their basic interest in school and grades.

Student Focus Group. The researchers conducted six student focus groups that involved a total of 58 students. Results from the focus groups closely align with findings from the student survey. When looking at learning and performance, the students indicated that they were more involved in writing, researching, and in collaborative project work. Many students reported an improvement in grades, although some students indicated there was no change in grades, and a few said some grades had dropped. Students felt they had a closer relationship with their teachers, more self-confidence, and improved attitudes towards school.

The majority of the students indicated that their parents liked the Laptop program. Others felt the Laptop program had improved relationships between students and their parents, that parents provided more help with homework, and that parents were amazed/happy at how quickly students had gained computer skills. All of the final comments were positive and indicated that the students liked having the laptop and looked forward to using it again next year.

Teacher Reactions

Teacher Survey. Thirteen Laptop teachers responded to the Teacher Survey. Results indicated that teachers were extremely positive regarding the benefits of the Laptop Program for them and their students. All agreed that the program experience: (a) increased their basic skills in computer applications, (b) increased the emphasis on higher-order learning in their classroom, (c) increased project-based learning, and (d) was beneficial to them as teachers. There was also strong agreement that they: were better prepared to create lessons integrating computers, frequently integrated technology, school-related interactions with students and parents increased, and would like to participate in the project again next year.

The teachers indicated that the greatest benefit of the Laptop program was for students to have access to technology and Internet resources. The teachers also felt that use of the laptop had resulted in students having greater research skills, improved writing skills, interest in school, and greater self-confidence. The difficulties cited were all related to the technology itself, e.g., power, weight, drives, server, and printers. They were also concerned with students tampering with software and the laptop settings. As could be expected, teachers indicated that the program could be improved by providing more technical support, more basic training, providing a solution to the power problems and providing more projectors.

Teacher Interviews. There were seven randomly selected Laptop teachers who were interviewed. Teachers indicated that classroom practices had changed due to the laptops in that they used more cooperative learning, completed more projects, and acted as facilitators of learning more frequently. Teachers reported that the projects involved more integration of subjects, research, higher-levels of learning, writing, and the use of spreadsheets, word processing, and the Internet than non-laptop projects. The teachers reported that they use authentic assessment and involve students in self-assessment and the development of rubrics now more frequently. As a result, teachers indicated that students produce higher quality work and had more self-confidence, greater enthusiasm, increased depth of knowledge, and were more engaged with other learners. Teachers indicated that there were fewer missed assignments and an overall improvement in grades.

Parent Reactions

Parent Survey. Encouragingly, parents (n = 187) generally viewed the Laptop Program as helpful to their children's education. More than half felt that the program *increased* their child's interest in school, involvement in project-type school work, and research skills. Between one-third to one-half

believed that increases occurred in school achievement, writing skills, and ability to work with other students.

Results from the open-ended items show that over one-half of the parents stated that the most beneficial part of the Laptop program was that their child had improved his/her knowledge in different subject areas and also improved in computer literacy. The parents expressed concerns that it was difficult for their child to keep track of, be responsible for, and carry the laptop to and from school. Other concerns were related to monitoring student use of the Internet and overuse of computer games. The parents felt that more training is needed for teachers, parents and students (keyboarding). Another suggestion was to offer the program to all students in the district.

Parent Interview. The parent interviews were conducted with a random selection of 40 parents (20 5th grade, 20 6th grade) whose children were participating in the Laptop study. Overall, the parents were supportive of the Laptop Program and felt that it has had a positive impact on the child's learning and participation in school. There was a general consensus that the Laptop Program was providing their child with important computer, organizational, and research skills that are of benefit now and will enhance their future work opportunities. Most of the parents indicated that the laptop had little influence on the family, however, a few noted positive impacts on younger siblings. The majority of the parents also reported that the laptop had not changed interactions with the child or teacher primarily because they were already actively involved.

Discussion

Results of this study suggest varied impacts of the Laptop Program on students, teachers, and family members. These findings are discussed below in reference to the three primary research questions.

Is Teaching Different in a Laptop Classroom?

According to both teacher reports and classroom observations, Laptop classes are being taught differently than regular (Control) classes. Not only did the former classes incorporate technology to a much greater degree, they tended to employ more student-centered strategies such as project-based learning, independent inquiry/research, teacher as coach/facilitator, and cooperative learning. Most revealing in the study were the ways in which technology was accessed and employed in the Laptop classrooms. Compared to their Control counterparts, the Laptop students demonstrated more technical skill with computers and used computers more extensively for a variety of production and research functions. Not surprisingly, observers rated Laptop classes as making much more *meaningful* usage of computers as educational tools.

Nearly all teachers believed that they were teaching differently than before by integrating technology into both newly developed lessons and existing lessons that had previously been taught without computers. Further, nearly all felt that they had increased the frequency of project-based learning, higher-order learning activity, and school-related interactions with parents and students. Laptop parents reported that their child was taking advantage of the laptop computer for school and other activities, especially in developing research skills.

The implication from these multiple data sources is that teaching and learning were being impacted, in ways that promoted active learning and technology applications, as a consequence of all students having continual access to individual computers. Not surprisingly, although cooperative learning was observed relatively frequently in Laptop classes, students typically worked individually while using computers. Thus, they benefited from having their own computer to complete their work, while still being able to collaborate easily with others on information and strategies.

Do Students Behave Differently in a Laptop Classroom?

As described above, Laptop students were more active, autonomous, and collaborative in their classroom behaviors. For example, cooperative learning was observed "frequently" or "extensively" in 35% of the Laptop classes, but only 11% of the Control classes. Students frequently or extensively engaged in projects in 55% of the Laptop classes compared to only 17% of the Control classes. Laptop teachers confirmed these impressions by describing their students as more independent, active, and engaged. The teachers were highly impressed with students' abilities and interests in using computers to enhance learning.

In their survey and interview responses, students indicated they had increased their computer skills substantially and were much more prepared to do Internet research. About two-thirds of the students generally worked with the laptop alone in the classroom, but they still collaborated frequently with others in sharing information, asking questions, and providing assistance. As a group, the students were less committal about the effects of the laptop in increasing the interest in learning, writing skills, and facilitating collaboration, although about one-third (still a substantial number) felt that they did realize these types of benefits.

Do Students Achieve Differently in a Laptop Classroom?

In this study, we assessed student achievement in terms of writing performance on a prompted essay. Grading, using a four-point rubric, was "blind" to students' enrollment in Laptop vs. Control classes. Results significantly favored the Laptop group on all evaluation dimensions—Organization, Ideas, Style, and Conventions. Aside from being statistically significant, the differences across all dimensions reflected relatively strong advantages for the Laptop group, with effect sizes ranging from +0.61 to +0.78.

Conclusions

In this evaluation of the first year of the Laptop Program, the results are consistently supportive of beneficial impacts on students, teachers, and parents. Specifically, all three groups believed that the program was positively changing teaching and learning both at school and at home. These impressions were directly confirmed in visits to Laptop versus Control classrooms. While more research is needed on how the Laptop Program impacts student achievement, the positive results from the writing assessment are highly suggestive. Laptop students were doing more sustained writing in class and were demonstrating more skill in writing, making a causal connection highly likely. Control classes could also increase their emphasis on writing, but it is obvious that continual and immediate access to computers provided the Laptop students and their teachers with a very strong advantage. In future research, we hope to examine whether Laptop students demonstrate comparable advantages in problem solving. We anticipate that they will, given the extensive project and inquiry activities in which they engage. At this point, given the present data, we are most certain of one program result—Laptop students are much more fluent than other students with using the technology of the 21st Century for learning, research, and production. For them, computers are fully integrated with and a natural part of their educational experiences both at school and at home.

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