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Program Evaluation:
The New York City Board of Education
Community School District Six
Laptop Project

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I. Introduction

A. Project Overview

The Laptop Project, in New York City's Community School District Six, has recently completed its second full phase of implementation. The program began in Fall 1996 with one pilot fifth grade class at Mott Hall School. The following fall (1997) saw the implementation of the laptop program in 17 classes throughout the district. The third phase began during the summer of 1998 with a laptop summer camp for an additional 500 children who were trained as 'student experts' and are facilitating the process of implementing the laptop computers into 81 additional classes during the 1998-99 academic year. From the beginning of the laptop project, Metis Associates, an independent research organization, has been conducting an evaluation of the implementation process and student, teacher, and parent outcomes. The early experiences of the pilot program are detailed in a March 1997 report entitled "Pilot Evaluation Report: Achieving Equity of Information Technology Access," available through Metis Associates and Community School District Six. The following report summarizes the activities and events of the laptop project and presents student achievement data for the first and second years of the laptop initiative.

B. Community School District Six

Community School District Six is located in the Washington Heights and Inwood sections of Manhattan. Geographically, the district ranges from the Harlem River in the east, to the Hudson River in the west, and from 220th Street in the north, to 135th Street in the south. This New York City school district, with 25 schools--17 elementary and 8 intermediate--serves approximately 28,000 students, nearly all of whom come from low-income families. (Approximately 95 percent of the district's school children are eligible for free or reduced price lunch.)

The vast majority of students in District Six (over 89 percent) are of Hispanic origin. Eight percent of the district's students are African-American, and the remaining three percent of the student body consists of other ethnic groups. Many of the district's Hispanic children, or their families, are recent immigrants to the United States and speak little or no English. With nearly 40 percent of the district's students identified as being limited English proficient (LEP), District Six operates the largest bilingual education program in New York State.

District Six has made a commitment to and has established a foundation for teaching with technology. Students in the district use 1,764 computers in 46 computer labs and 432

classrooms. While the District's existing programs provide technologically enriching experiences for participating students, teachers, and parents, each has been limited by time constraints and issues surrounding access to technology. The Laptop Program affords students, teachers, and parents unlimited opportunities to develop their academic and computer skills, leading to practical and invaluable educational experiences. The expectation is that using laptops in the classroom will increase students' motivation to learn and will assist in developing higher order thinking skills, ultimately leading to increased academic achievement as measured by standardized tests and authentic assessments.

C. Program Goals

With the laptop initiative, District Six hopes to achieve the following four long-term goals:

Goal 1: *To provide students greater access to technology in school and at home which will change the nature and quality of instruction, change how and what they learn in their classes, change how they approach and complete school work, increase their knowledge and use of computer technology, and increase self-esteem and foster positive attitudes toward school and learning.*

Goal 2: *To provide ongoing professional development activities for teachers, administrators, and other staff to integrate the use of technology into curriculum-based instruction.*

Goal 3: *To encourage parents' involvement in their children's education and to provide opportunities and training activities for parents to increase their computer skills.*

Goal 4: *To infuse technology into the curriculum in such a way that results in improvement of any activity intended to increase knowledge and thinking skills.*

D. Evaluation of the Laptop Project

Metis Associates, Inc., was retained by District Six to evaluate the Laptop Project throughout its stages of implementation. The following questions have guided the evaluation:

C ***Student achievement***

To what extent does the academic achievement of the participating students improve?
How does the program affect students' language arts skills?
How does the program affect students' technology skills?
Will the laptop program affect how students approach and complete schoolwork?
In what ways has the integration of educational technology into the curriculum affected student motivation and learning?
How does the program affect students' future career goals?

- ***Professional development of teachers, administrators, and other staff***

What is the nature and perceived impact of laptop training on project staff attitudes toward and skill with the technology?
How and to what extent do the participating teachers integrate technology into their regular classroom instruction?
In what ways will the technology project change teachers' roles from instructors or 'knowledge providers' to collaborators and facilitators of learning?

- ***Parent involvement***

What impact will the laptop have on parent involvement and their use of technology?

- ***Program implementation***

Will the security and maintenance policies be effective?
Are there differences between the laptop computer models (IBM, Toshiba) being used in terms of maintenance and ease of use?

In order to obtain answers to these questions, Metis has been using a variety of evaluation data including: student standardized test scores; student, teacher, and parent survey results; focus group meetings with students and parents; full-day observations of classroom activities; review of student projects; and ongoing consultation, including individual interviews with program staff and administrators. In addition to a summary of the program's activities, this report presents student achievement outcomes for the first and second year of program implementation, 1996-97 and 1997-98.

II. Phase One: 1996-1998 Pilot Study at Mott Hall

The Laptop Project stems from a program initiated by Microsoft and Toshiba in Australia entitled *SchoolBooks*, where parents lease laptop computers, providing students with access to technology as a learning tool throughout the school day and at home. Community School District Six began their collaboration with the Microsoft Corporation and Toshiba in the fall of 1996. The Superintendent's intent was to pilot the Schoolbooks Project in two sites: one in a school where the students' possess strong academic skills and the other in a school more typical of the district where substantial numbers of students are performing below grade level. However, due to financial issues, only one pilot site was funded and the district's decision was to choose the academically selective school.

A. The Pilot Site

The site for District Six's pilot of the SchoolBooks Project was the Mott Hall School (IS 223), an intermediate school with approximately 430 students in grades four through eight. The school has a competitive admissions process and places emphasis in the curriculum on math,

science, and technology. Students at Mott Hall are chosen through a selective admissions process where students achieving above the 80th percentile on standardized reading and math tests are first nominated by their school for admission. These students are then considered for admission based on their score on a standardized test used specifically for admission purposes, a personal interview, and teacher recommendations. The Mott Hall School is the highest ranking public school in New York City in reading and math standardized test scores.

B. Pilot Class Description

The principal of Mott Hall selected a fifth grade class to participate in the pilot program. The class consisted of 19 students, 11 girls and 8 boys. Fourteen students were from a Hispanic background, three were African-American, and two were Asian. The children's academic performance, based on their grades and standardized test scores, was near the median as compared to their peers in the other fifth-grade classes at the school. This particular class was chosen because of the enthusiasm of the homeroom teacher, who volunteered to undertake the project. In addition, the school's computer instructor also participated in the pilot program.

C. Professional Development

The pilot class teachers engaged in two types of professional development activities: computer training in the Microsoft Office software applications and curriculum integration training. Microsoft provided the first series of computer training, which enabled the communication arts and computer teachers to receive four free courses at *New Horizons Computer Learning Center of Metropolitan New York*. Both teachers received their own laptops and began their computer training in early September 1996. Each attended two sessions that focused on Microsoft Word, one on Microsoft Excel, and one on Microsoft PowerPoint. In addition, the district arranged for an all-day session of computer training for 12 staff members, including the district's curriculum coordinators, the other fifth-grade teachers at Mott Hall, and additional staff members.

The second type of training was intended to assist teachers in integrating the laptops into the curriculum. An all-day workshop, sponsored by Microsoft and facilitated by People's Computer Company (PCC Inc.), was held at the district office on October 18, 1996. Participants included staff members from Mott Hall as well as teachers from other potential sites in the district. The session was developed to offer teachers hands-on experiences and knowledge to begin integrating the curriculum and laptop technology. The facilitators provided attendees with materials for developing laptop exercises, lesson plans, class activity plans, and other resources.

D. Laptop Distribution

Table 1 contains the specifications of the laptops used in this pilot of the laptop project.

Table 1
Laptop Specifications

Processor	Pentium 75 MHZ
Memory	16MB
Hard Disk	528MB
Power	Lithium Ion Battery (Latest technology with 3.5 hour life)
	Internal AC Adapter
Security	Kensington Lock Slot, Power on Password, Keyboard Lock
Warranty	Comprehensive Three Year
Support	24 hour, 7 day a week via Toll Free 800 number
Modem	14.4 bps XJACK Data/Fax Modem
Pointing Device	AccuPoint Integrated Pointing Device
Speakers	Internal Speaker with Volume Control Knob
Preloaded Software	Microsoft Windows95
	Microsoft Office Standard
Carry Case	Backpack laptop computer case

The students and their parents received their laptops on November 7, 1996, at an orientation held at the district office. All the children and their parents attended this orientation which was facilitated by both district and school personnel, the technology consultant, and the reseller who worked with the district. The procedures for traveling to and from school, security policies, maintenance issues, and the rental agreement were reviewed.

E. Learning with Laptops

Mott Hall's instructional model influenced the subjects and number of hours in which the students used the laptop in school. Unlike most fifth-grade classes in District Six, which are self-contained, the Mott Hall School uses a departmentalized model where the students switch classrooms and teachers for instruction in different subject areas. Though the communication arts and computer instructors were the only two teachers who had received training prior to implementing the program, they were expected to turnkey this training with the other curriculum area teachers working with these students. It was critical to the implementation of this project that all of the students' teachers utilize the potential of computer-based technology to support the teaching-learning environment in their discipline.

The two teachers worked closely together to integrate the software applications with the curriculum, helping to ensure that the transition to using laptops in class facilitated instruction in the content areas. Both teachers were creative and innovative in developing lessons and projects for the children so that they would acquire computer skills and learn communication arts. The computer instructor planned his lessons based on assignments given in the communication arts class. The communication arts teacher would often inform the computer instructor of upcoming projects or activities and the information the students would need to manipulate. He would then plan activities and lessons that simultaneously helped the children learn the software and ways to

generate the necessary information. The computer teacher did very little teaching of software applications, focusing about 20 percent of his time on software applications and 80 percent on integrating the software into the curriculum.

Similarly, the second year of the program continued the collaboration between the computer teacher and a sixth grade laptop teacher. Students continued to utilize their laptop in daily classroom instruction and participated in a variety of increasingly challenging projects. Students used the laptop to write reports, analyze data, make tables and graphs, and perform oral presentations using PowerPoint slides.

F. Survey Findings

Metis used a variety of evaluation techniques including the development and analysis of student and parent surveys; focus group meetings with students and parents; observations of classroom activities; and ongoing consultation, including individual interviews, with Mott Hall staff.

Student Perceptions

A locally developed survey was designed and administered in January 1997 to students to learn how they spent their time before and after the pilot program and how they used the laptops in school and at home. All 19 students in the class completed the survey, which consisted of short-answer and open-ended questions. The results of selected short-answer questions are displayed in Table 2 below.

Table 2
Frequency Distribution of Student Survey Responses
1996-97 Academic Year

Survey Item (N = 19[1])	**Student Responses: Number (Percent)**		
Time spent on the following activities after receiving laptop:	*MORE*	*LESS*	*SAME*
homework	11 (61%)	4 (22%)	3 (17%)
watching TV	1 (5%)	17 (90%)	1 (5%)
talking on the telephone	4 (24%)	11 (65%)	2 (11%)
extracurricular activities	2 (13%)	11 (74%)	2 (13%)
playing video games (Nintendo, Sega)	2 (17%)	10 (83%)	--
Students used their laptop to:	*Never or Rarely*	*Sometimes*	*Most times or Always*
do daily homework	2 (11%)	8 (42%)	9 (47%)
work on school projects	0 (0%)	4 (21%)	15 (79%)
play games	10 (53%)	8 (42%)	1 (5%)
learn software applications	3 (16%)	5 (26%)	11 (58%)
create their own documents	3 (16%)	7 (37%)	9 (47%)
work with parents on school projects	10 (53%)	8 (42%)	1 (5%)
work with parents on work not related to school	12 (63%)	6 (32%)	1 (5%)
work with sibling/friend on their school work	12 (63%)	5 (26%)	2 (11%)

Student responses to the survey revealed a change in the amount of time students spent on their school work and other activities outside school after receiving the laptop. For example, over half (61 percent) reported spending more time on their homework after receiving the laptop. Moreover, 90 percent of the children said they spent less time watching television, talking on the telephone (65 percent), and playing video games (83 percent). The findings also show that 47 percent of the class used the laptop most of the time or always to do their daily homework, while 79 percent of the students used it most of the time or always to work on school projects. Interestingly, nearly two-thirds of the children replied that they never or rarely worked with a parent, sibling, or friend on school-related projects or other work.

Many students (79 percent) also reported that they believed having a laptop has improved their performance in school. In focus group interviews, students stated that having a laptop has helped them become more responsible. Students also indicated that having a laptop has improved the spelling, neatness, and clarity of their written work. For example, students replied that:

> *It [the laptop] improved my typing skills and it organizes my information. Now I am more organized.*
>
> *It's [student's work] is more organized and neater.*

[1] Students who did not respond or answered N/A were excluded from the findings.

In addition to acquiring technical knowledge and helping the students with their school work, the pilot program appears to have enabled students to develop their skills in other areas such as organization and problem solving.

Parent Perceptions

A locally developed survey was designed and administered to parents, at the same time of the student survey, to learn about their involvement in their children's education, particularly in the SchoolBooks Project; whether and how they used the laptops at home; and their overall satisfaction with the program. Table 3, below, summarizes parents' answers to the short-answer questions.

Table 3
Frequency Distribution of Parent Survey Responses
1996-1997 Academic Year

Survey Item (N = 14[2])	**Parent Responses Number (Percent)**		
Time spent on the following since child received a laptop:	*MORE*		*LESS*
helping with homework or school-related activities	11 (85%)		2 (15%)
reading and/or learning about computer technology	11 (85%)		2 (15%)
working with child on computer activities unrelated to school	9 (82%)		2 (18%)
Parents used the laptop to:	***Never or Rarely***	***Sometimes***	***Most times or Always***
help child with homework	3 (21%)	7 (50%)	4 (29%)
create personal documents	10 (72%)	2 (14%)	2 (14%)
do their own professional or job-related work	8 (58%)	3 (21%)	3 (21%)

The findings reveal that 85 percent of the parents spent more time helping their children with their homework or school-related activities and reading and learning about computer technology since their child received a laptop. Moreover, 82 percent of the parents reported spending more time with their child on computer activities that were unrelated to school. When parents used the laptop, 79 percent indicated that they used it at least sometimes or always to help their child with homework, while 42 percent used it at least sometimes or always for their own professional or work-related purposes. Seventy-nine percent of the parents reported that they believe having a laptop is improving their child's performance. In focus group interviews, parents responded that their child studies more and/or has improved study habits. In addition, they found their children to be more interested in work and learning and more able to work independently in completing homework and school projects.

[2] Parents who did not respond or answered N/A were excluded from the findings.

Staff Perceptions

Interviews with the staff at the pilot site revealed that since implementing the program they have seen changes with the children and in the classroom. The students became more organized and responsible for their work and for the laptop itself. The children showed increased motivation to learn and a positive attitude toward school. The communication arts teacher stated that after receiving the laptops the students' "academic drive" was different compared to other classes--they were more committed and willing to do additional work at home. The computer instructor commented that using laptops changed the whole environment of the classroom. For example, both teachers observed that new leaders emerged in the class. In addition, teachers indicated that the children often managed themselves and, while they worked collaboratively, the teacher provided individual attention to the students who needed extra help. Equally as important was that teachers could now plan interesting and complex homework projects which is something that was not possible with desktop computers.

G. Student Attendance

The following section presents findings of student attendance for 1996, 1997, and 1998 based on the total number of possible days that students could have attended school. There are two types of tables presented: tables showing matched longitudinal attendance data from one year to the next year, and tables showing students' attendance on an annual basis. Because students participating in the laptop project were a subset of the total number of fifth grade students at Mott Hall, analyses were conducted comparing the laptop students to their non-laptop peers at Mott Hall.

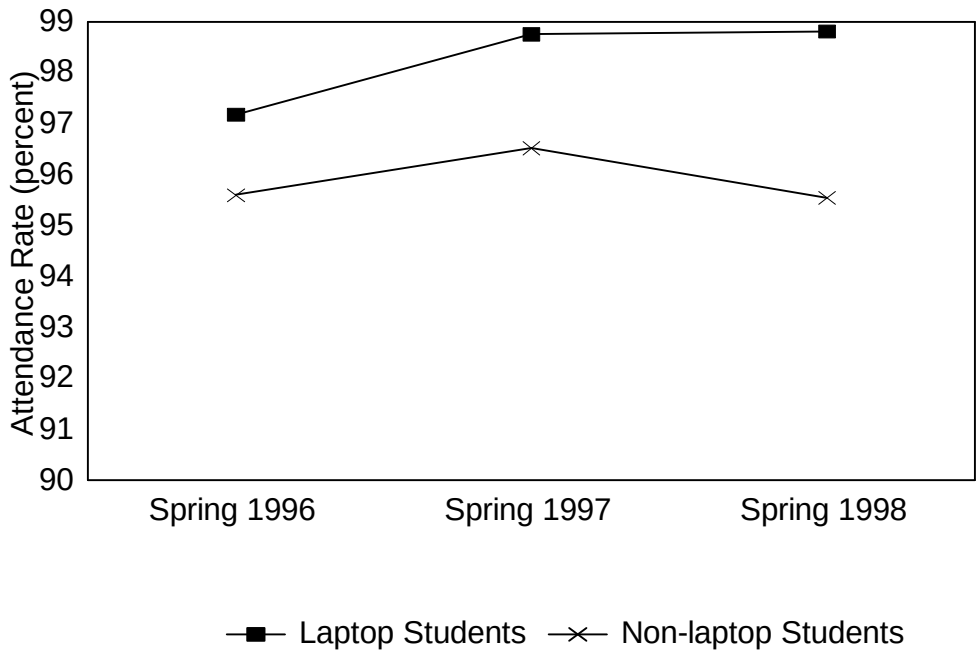
Attendance rates for laptop and non-laptop students are displayed as a percentage of the number of days students attended school out of the total number of possible days that students could have attended school (Average Daily Attendance) during the 1995-96, 1996-97, and 1997-98 academic years. Table 4 and Figure 1 display the results.

Table 4
Comparison of Attendance Rates for Laptop and Non-laptop Mott Hall Students
Spring 1996, 1997, and 1998

	Laptop Students		Non-laptop Students		Mean Difference
	N	ADA	N	ADA	
Spring 1996	19	97.18%	74	95.60%	1.58%
Spring 1997	19	98.76%	76	96.52%	2.23%*
Spring 1998	19	98.81%	76	95.54%	3.27%*

*Statistically significant at or below the .05 level of probability on an independent samples *t* test

Figure 1
Comparison of Attendance Rates for Laptop and Non-laptop Mott Hall Students
Spring 1996, 1997, and 1998



As shown in Table 4, there was no significant difference in laptop and non-laptop students' attendance rates during the 1995-96 school year (before laptop implementation). Laptop students had an average daily attendance of 97.18 percent and non-laptop students had an average daily attendance of 95.60 percent. However, during the first year of the laptop program (1996-97), students who were participating in the laptop project achieved a greater attendance rate than those students who were not participating in the laptop project (laptop students' ADA was 98.76 percent while non-laptop students' ADA was 96.53 percent). Laptop students maintained this higher attendance rate throughout the second year of the program (1997-98) with an average attendance rate of 98.81 percent while their non-laptop peers had only a 95.54 percent ADA.

A longitudinal analysis was conducted in which differences in laptop and non-laptop students' attendance rates was analyzed over sequential academic years. When examining the results of longitudinal analyses, only mean differences that are statistically significant can be considered gains or declines. Nonsignificant differences between attendance rates are considered to reflect no change.[3] Each longitudinal analysis shows the number of students with matched pre- and post attendance rates, pre- and post- means, mean differences, and an asterisk if the difference between the pre- and post-attendance means resulted in a significant *t* value at the .05 level of probability. Each analysis also shows the percent of students whose post-attendance rate exceeded the pre-attendance rate. The following longitudinal analysis compares matched (pre- and post-) student attendance data from the 1995-96 and 1996-97 academic years in order to examine the effect the laptop program has on student attendance. The results are shown in Table 5.

Table 5
Longitudinal Analysis of Attendance Rates for Laptop and Non-laptop Mott Hall Students
Spring 1996 - Spring 1997

Mott Hall Fifth Grade Students in 1996-97	**N**	**Spring 1996 (Baseline)**	**Spring 1997 (First Year Laptop program)**	**Mean Difference**	**Percent of Students Whose Attendance Increased**
		ADA	**ADA**		
Laptop Students	18	97.53%	98.69%	1.15%	67%
Non-laptop Students	74	95.61%	96.51%	.90%*	61%

*Statistically significant at or below the .05 level of probability on a correlated samples *t* test

Although student attendance at Mott Hall school was relatively high overall, non-laptop students significantly increased their average daily attendance between the 1995-96 and 1996-97 academic years achieving ADAs of 95.61 percent and 96.51 percent, respectively. Results also indicated that laptop students maintained their already high student attendance rate between the

[3] While any change in an individual's attendance rate is meaningful, mean differences that are not statistically significant reflect data where the number of students is too small and/or variations in students' rates are too large to make general statements about the group.

1995-96 and 1996-97 school years with an ADA of 97.53 percent in the baseline year (1995-96) and an ADA of 98.69 percent in the first year of the program (1996-97). Analysis of individual student attendance records indicated that in the first year of the laptop program, 10 of the 18 participating laptop students had perfect attendance (100 percent). Overall, 67 percent of the laptop students and 61 percent of the non-laptop students attended school more days during the 1996-97 school year than the 1995-96 school year.

Longitudinal analyses comparing student attendance rates for laptop and non-laptop students between 1996-97 and 1997-98 were also conducted. Table 6 displays the results.

Table 6
Longitudinal Analysis of Attendance Rates for Laptop and Non-Laptop Mott Hall Students
Spring 1997 - Spring 1998

Mott Hall Sixth Grade Students in 1997-98	**N**	**Spring 1997 (First year laptop program)**	**Spring 1998 (Second year Laptop program)**	**Mean Difference**	**Percent of Students Whose Attendance Increased**
		ADA	**ADA**		
Laptop Students	19	98.76%	98.81%	.06%	16%
Non-laptop Students	74	96.49%	95.49%	-1.00%	47%

The findings from Table 6 indicate that there was no difference in average daily attendance rates for laptop and non-laptop students between the 1996-97 and 1997-98 academic years. Although Mott Hall student attendance rates were already high, it appears that the second year of the laptop program did not effect the amount of days that students attended school. Students maintained their high level of school attendance with an ADA of 98.76 percent in 1996-97 and an ADA of 98.81 percent in 1997-98. Similarly, there was no difference in non-laptop student attendance between 1996-97 and 1997-98 school years, achieving ADAs of 96.49 percent and 95.49 percent, respectively.

Table 7 displays the results of a two-year (1995-96 and 1997-98) longitudinal comparison of matched attendance rates for laptop and non-laptop students.

Table 7
Longitudinal Analysis of Attendance Rates for Laptop and Non-laptop Mott Hall Students
Spring 1996 - Spring 1998

Mott Hall Sixth Grade Students in 1997-98	N	Spring 1996 (Baseline)	Spring 1998 (Second Year Laptop Program)	Mean Difference	Percent of Students Whose Attendance Increased
		ADA	ADA		
Laptop Students	18	97.53%	98.78%	1.25%*	78%
Non-laptop Students	72	95.62%	95.41%	-.21%	64%

*Statistically significant at or below the .05 level of probability on a correlated samples *t* test

According to the two-year longitudinal analysis, it appears that participating in a laptop project significantly increased students' attendance. Students in the laptop project achieved a greater attendance rate during the 1997-98 academic year than they did before the laptop project began (1995-96 academic year), achieving ADAs of 97.53 percent and 98.78 percent, respectively. Seventy-eight percent of the laptop students increased their attendance over the two years of program participation. Non-laptop student attendance did not change over the two years (an ADA of 95.62 percent in 1995-96 and an ADA of 95.41 percent in 1997-98).

H. Student Achievement: Two Year Longitudinal Study of the Pilot Laptop Program

The following section presents findings of analyses of reading and mathematics achievement for 1996, 1997, and 1998, based on the annual New York City reading and mathematics testing programs for students participating in the pilot laptop project at Mott Hall. Again, there are two types of tables presented: tables showing matched (pre/post) longitudinal performance from one year's testing program to the next year's testing program, and tables showing students' performance on selected measures on an annual basis. Because students participating in the laptop project were a subset of the total number of fifth grade students at Mott Hall, analyses were conducted comparing the laptop students to their non-laptop peers at Mott Hall.

CAT Mathematics

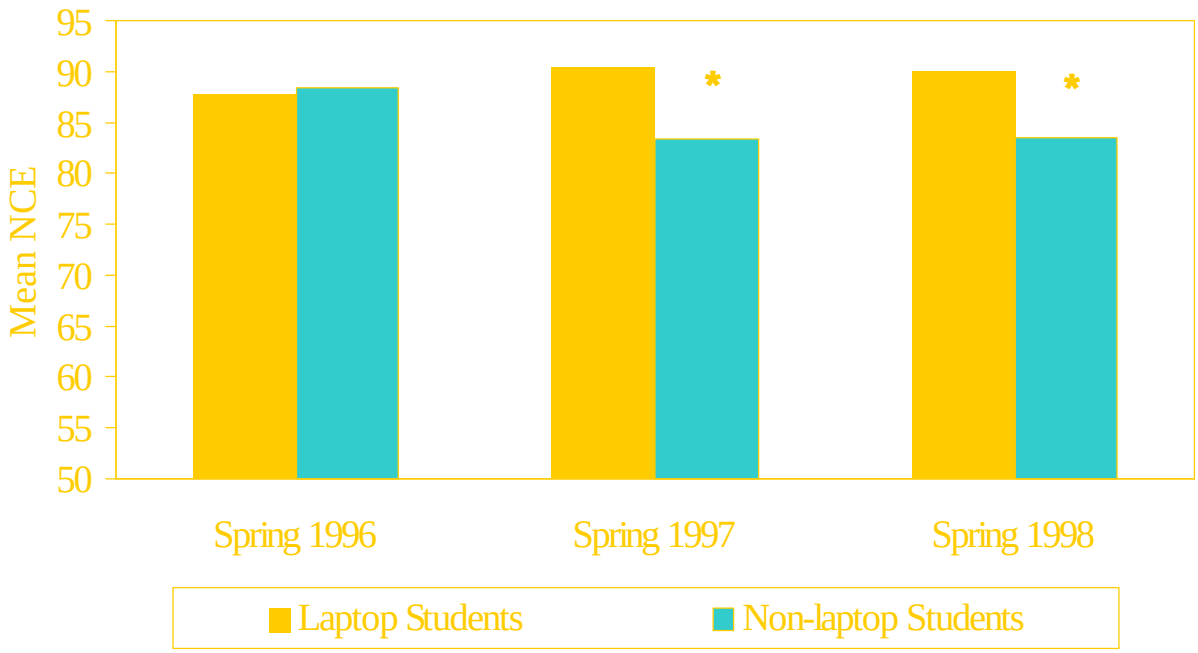
Student performance in mathematics was examined through an analysis of student CAT scores for both laptop and non-laptop students. Student performance on the CAT in Spring 1996 (before laptop implementation) was used as the pretest measure. Since only two students took the CAT translated (CTN) in 1996, and no students took the CTN in 1997 or 1998, CTN scores were dropped from the analyses. Table 8 and Figure 2 display the results of a comparison of mean CAT scores for laptop and non-laptop students.

Table 8
CAT Mathematics Scores for Laptop and Non-laptop Mott Hall Students
Spring 1996, 1997, and 1998

	Laptop Students		Non-laptop Students		Mean Difference (in NCEs)
	N	Mean NCE	N	Mean NCE	
Spring 1996	19	87.84	67	88.37	-.53
Spring 1997	19	90.37	76	83.30	7.07*
Spring 1998	19	89.95	74	83.57	6.38*

*Statistically significant at or below the .05 level of probability on an independent samples *t* test

Figure 2
CAT Mathematics Scores for Laptop and Non-Laptop Mott Hall Students
Spring 1996, 1997, and 1998



As shown, in Spring 1996 (before the implementation of the laptop program), there was no difference between laptop and non-laptop students' math performance. Participants achieved a mean score of 87.84 NCEs while their non-laptop peers achieved a mean score of 88.37 NCEs. However, after a year of daily instruction with laptop computers, there was a significant difference in laptop and non-laptop students' CAT scores. In Spring 1997, laptop students' CAT math scores (mean score of 90.37 NCEs) were statistically higher than their non-laptop peers (mean score of 83.30 NCEs). Analysis of the CAT data also indicated that this difference was maintained over the second year of the laptop program. In Spring 1998, the laptop students' mean math score (89.95 NCEs) remained significantly higher than non-laptop students' mean math score (83.57 NCEs).

A longitudinal analysis of CAT performance was conducted for laptop and non-laptop students with matched (pre/post) CAT data. Table 9 displays the results.

Table 9
Longitudinal Analysis of CAT Mathematics Scores
for Laptop and Non-laptop Mott Hall Students
Spring 1996-Spring 1997

Mott Hall Fifth Grade Students in Spring 1997	**N**	**Spring 1996 (Baseline)**	**Spring 1997 (First Year Laptop Program)**	**Mean Difference (in NCEs)**	**Percent of Students Whose Post >Pre**
		Mean NCE	**Mean NCE**		
Laptop Students	18	89.17	89.89	.72	39%
Non-laptop Students	67	88.37	85.18	-3.19*	30%

*Statistically significant at or below the .05 level of probability on a correlated samples *t* test

Interestingly, the results shown in Table 9 indicate that while laptop students were able to maintain their CAT performance relative to national norms between Spring 1996 and Spring 1997 (mean scores of 89.17 NCEs and 89.89 NCEs, respectively), non-laptop students experienced an average decline in math performance of 3.19 NCEs. More specifically, non-laptop students' average CAT score of 88.37 NCEs in Spring 1996 dropped to 85.18 NCEs in Spring 1997. It appears that participating in the laptop project helped to maintain students' math performance.

A longitudinal analysis of CAT performance was also conducted examining students' gains between Spring 1997 and Spring 1998. Results are displayed in Table 10.

Table 10
Longitudinal Analysis of CAT Mathematics Scores
for Laptop and Non-laptop Mott Hall Students
Spring 1997-Spring 1998

Mott Hall Sixth Grade Students in Spring 1998	N	Spring 1997 (First Year Laptop Program)	Spring 1998 (Second Year Laptop Program)	Mean Difference (in NCEs)	Percent of Students Whose Post > Pre
		Mean NCE	Mean NCE		
Laptop Students	19	90.37	89.95	-.42	26%
Non-laptop Students	73	82.90	83.70	.80	47%

*Statistically significant at or below the .05 level of probability on a correlated samples *t* test

An interpretation of Table 10 reveals that using a laptop computer did not affect students' CAT scores in the second year of the program. Although laptop students performed better on the CAT than their non-laptop peers, their math performance remained stable between 1997 and 1998 (mean score of 90.37 NCEs and 89.95 NCEs, respectively). Similarly, non-laptop students also maintained their level of math performance with a mean score of 82.90 NCEs in 1997 and 83.70 NCEs in 1998.

A two-year longitudinal analysis of CAT performance was conducted for laptop and non-laptop students. Results are displayed in Table 11.

Table 11
Longitudinal Analysis of CAT Mathematics Scores
for Laptop and Non-laptop Mott Hall Students
Spring 1996-Spring 1998

Mott Hall Sixth Grade Students in Spring 1998	N	Spring 1996 (Baseline)	Spring 1998 (Second Year Laptop Program)	Mean Difference (in NCEs)	Percent of Students Whose Post >Pre
		Mean NCE	Mean NCE		
Laptop Students	18	89.17	89.44	.28	33%
Non-laptop Students	64	88.02	85.41	-2.61*	34%

*Statistically significant at or below the .05 level of probability on a correlated samples *t* test

While laptop students maintained their CAT performance over the two years of program participation, non-laptop students showed a decrease in math performance. Laptop students achieved a mean CAT score of 89.17 NCEs in 1996 and 89.44 NCEs in 1998, two years later. However, non-laptop students showed a mean decline of 2.61 NCEs between 1996 and 1998 (mean score of 88.02 NCEs and 85.41 NCEs, respectively).

CTB Reading

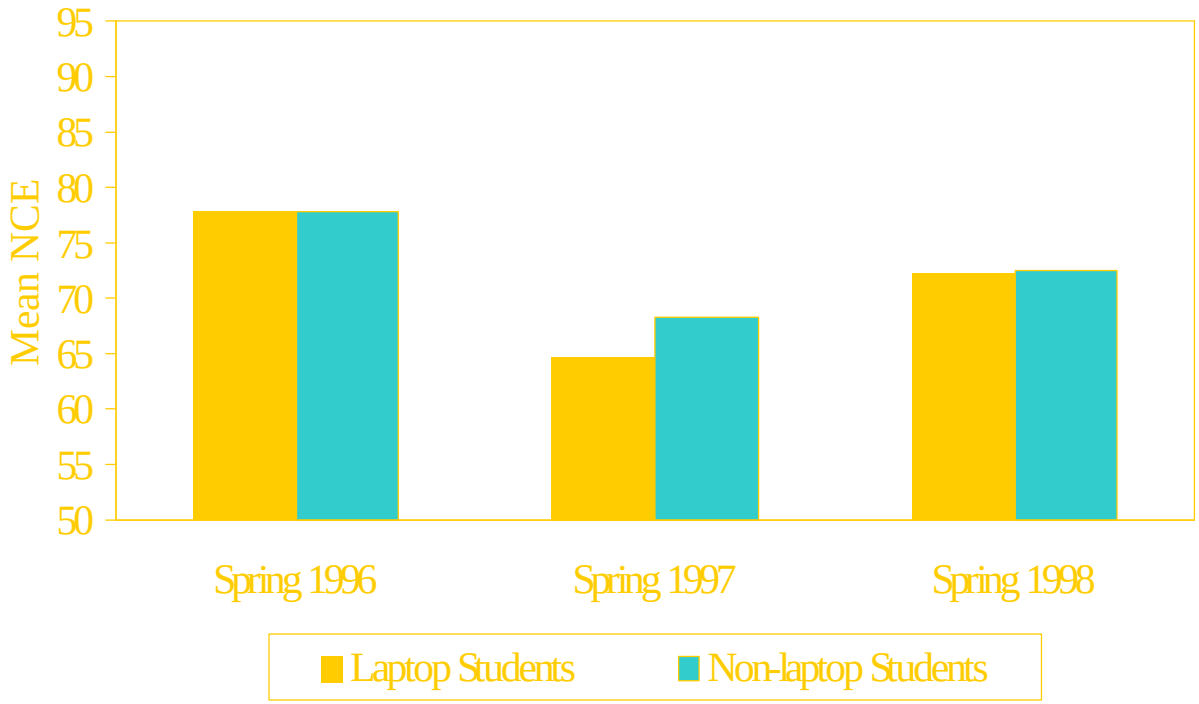
Reading achievement was measured as a function of student performance on the CTB reading test. Table 12 and Figure 3 show laptop and non-laptop students' CTB reading scores in Spring 1996 (baseline), 1997 (first year), and 1998 (second year).

Table 12
CTB Reading Scores for Laptop and Non-laptop Mott Hall Students
Spring 1996, 1997, and 1998

	Laptop Students		Non-Laptop Students		Mean Difference (in NCEs)
	N	Mean NCE	N	Mean NCE	
Spring 1996	19	77.89	70	77.76	.13
Spring 1997	18	64.61	73	68.21	-3.60
Spring 1998	19	72.26	71	72.54	-.28

*Statistically significant at or below the .05 level of probability on an independent samples *t* test

Figure 3
CTB Reading Scores for Laptop and Non-laptop Mott Hall Students
Spring 1996, 1997, and 1998



As shown, there was no difference between laptop and non-laptop students' CTB scores for Spring 1996, 1997, and 1998. In 1996, laptop students achieved a mean CTB score of 77.89 NCEs while non-laptop students achieved a mean of 77.76 NCEs. In Spring 1997, after participating in the laptop project for one year, laptop students scored an average of 64.61 NCEs while their non-participating peers scored an average of 68.21 NCEs. Even after two years of participation in the laptop program, there was no difference between laptop and non-laptop students' CTB scores: participants achieved a mean of 72.26 NCEs while non-participants averaged 72.54 NCEs.

Table 13 displays the longitudinal analysis for Spring 1996 to Spring 1997 for both laptop and non-laptop students.

Table 13
Longitudinal Analysis of CTB Reading Scores for Laptop and Non-laptop Mott Hall Students
Spring 1996-Spring 1997

Mott Hall Fifth Grade Students in Spring 1997	**N**	**Spring 1996 (Baseline)**	**Spring 1997 (First Year Laptop Program)**	**Mean Difference (in NCEs)**	**Percent of Students Whose Post > Pre**
		Mean NCE	**Mean NCE**		
Laptop Students	18	78.28	64.61	-13.67*	6%
Non-laptop Students	70	77.76	68.57	-9.19*	17%

*Statistically significant at or below the .05 level of probability on a correlated samples *t* test

Both laptop and non-laptop students did significantly less well on the CTB reading test in Spring 1997 than in Spring 1996. Laptop students experienced a mean decline of 13.67 NCEs from Spring 1996 to Spring 1997 (mean score of 78.28 NCEs and 64.61 NCEs, respectively). Only 6 percent of laptop students had a higher posttest (Spring 1997) than pretest (Spring 1996) score. Similarly, non-laptop students also experienced a significant decline in CTB scores from 1996 to 1997. In Spring 1997, non-laptop students achieved an average score of 68.57 NCEs, a notable decrease from their average Spring 1996 score of 77.76 NCEs. Only 17 percent of the non-laptop students did better in Spring 1997 than in Spring 1996.

Table 14 displays the longitudinal analyses of students' CTB scores from Spring 1997 to 1998.

Table 14
Longitudinal Analysis of CTB Reading Scores for Laptop and Non-laptop Mott Hall Students
Spring 1997-Spring 1998

Mott Hall Sixth Grade Students in Spring 1998	N	Spring 1997 (First Year Laptop Program)	Spring 1998 (Second Year Laptop Program)	Mean Difference (in NCEs)	Percent of Students Whose Post > Pre
		Mean NCE	Mean NCE		
Laptop Students	18	64.61	70.78	6.17*	78%
Non-laptop Students	70	68.29	72.56	4.27*	59%

*Statistically significant at or below the .05 level of probability on a correlated samples *t* test

Both laptop and non-laptop students significantly increased their CTB reading scores between Spring 1997 and Spring 1998. Seventy-eight percent of the laptop students performed better on the CTB reading test in Spring 1998 (mean score of 70.78 NCEs) than in Spring 1997 (mean score of 64.61 NCEs). Similarly, the non-laptop students increased their reading performance from a mean of 68.29 NCEs in 1996 to a mean of 72.56 NCEs in 1998. Fifty-nine percent of the non-laptop students increased their reading performance from 1997 to 1998.

A two-year longitudinal analysis was conducted to examine changes in reading performance over the course of the laptop program. Table 15 shows the average CTB scores for laptop and non-laptop students from Spring 1996 to Spring 1998.

Table 15
Longitudinal Analysis of CTB Reading Scores for Laptop and Non-laptop Mott Hall Students
Spring 1996-Spring 1998

Mott Hall Sixth Grade Students in Spring 1998	N	Spring 1996 (Baseline)	Spring 1998 (Second Year Laptop Program)	Mean Difference (in NCEs)	Percent of Students Whose Post > Pre
		Mean NCE	Mean NCE		
Laptop Students	18	78.28	70.78	-7.50	28%
Non-laptop Students	67	77.88	73.21	-4.67*	37%

*Statistically significant at or below the .05 level of probability on a correlated *t* test

Although analyses revealed that laptop students maintained their normative reading performance across two years of program participation, only 28 percent of the laptop students' CTB scores increased between Spring 1996 and Spring 1998. However, non-laptop students experienced a significant decline in their reading performance between 1996 and 1998.

I. Summary of Mott Hall Pilot Class Data

Evaluation of the first and second years of the pilot program at the Mott Hall School revealed several key findings. During the first year of laptop implementation, students reported spending more time on homework and less time watching television and talking on the phone. It appears that having a laptop computer positively impacted the amount of time spent on schoolwork and other computer activities while simultaneously decreasing the amount of time spent on outside leisure activities. In addition, teachers reported that students were more organized and more willing to do schoolwork. Teachers were able to plan increasingly complex projects and act more like 'facilitators of learning' than 'knowledge providers.'

Further evidence of students' increased interest in learning and school comes from the student attendance data, which showed that laptop students maintained their high school attendance rate during the first year of the program. One possible explanation is that this positive finding is due to a novelty effect in which beginning laptop students spend more time on schoolwork and are more interested in learning because they are unfamiliar with the technology. However, analysis of attendance data during students' second year of program participation revealed that laptop students maintained their already high attendance rate. It appears that the first year of laptop program participation increases students' school attendance rate and this does not decrease even as students become more familiar with the technology in subsequent years. The finding that students spend significantly more time in school indicates that the laptop program has the potential to increase student interest in learning more than the traditional classroom.

An additional interesting finding was that using a laptop computer in daily instruction helped support students' math skills. Laptop students were able to maintain their math performance over the two years of the program, while non-laptop students' math performance underwent a significant decline over the same time frame. Similarly, two year longitudinal analyses revealed that laptop students were able to maintain their performance on the CTB reading test.

Because students at Mott Hall are selected for inclusion in the school based on academic ability, it may be the case that the measures used to assess student achievement were not able to adequately capture gains because student performance was initially very high. However, analysis of student scores and the percent of students whose posttest was greater then pretest indicated that students still have room for improvement. The laptop medium has enabled students to work on a variety of multi-disciplinary, innovative projects. While the program has already challenged students' thinking skills and moved toward an inquiry-oriented model of classroom instruction, additional ways to use the laptop as a learning tool have the potential to further enhance academic learning. It is suggested that time and resources be allocated to the process of designing an effective and challenging laptop curriculum for second and third year laptop users to ensure that the program continues to support student gains in achievement. Use of the laptop has increased student attendance, motivation, and interest in learning. It is important to focus this energy and enthusiasm on curriculum lessons that are technologically challenging while still supporting reading, writing, and math skills.

III. Phase Two: 1997-1998 *Project Smart* Schools

The second phase of the laptop project was implemented with financial support from the New York City funded *Project Smart Schools Initiative*. Originally allocated for the purpose of providing each classroom with four personal computers, permission was obtained to use the money to purchase laptop computers for students in 17 classrooms throughout the district. Preparation for this phase of the project began in the Summer of 1997 with an intensive professional development institute for teachers. Approximately 77 teachers received training on the laptop computers. The training included an orientation to Windows '95 and hands-on activities to familiarize participants with Microsoft Office '97 software (e.g., Word, Excel, and PowerPoint). In addition, trainees learned how to install CD-ROMs and save work to a disk as well as received tips and information about integrating the software tools into the curriculum. Other lesson topics included debugging, parental involvement, classroom environment, and safety and security.

In October 1997, 17 classes of sixth grade students throughout the district (excluding the pilot class at Mott Hall) began participating in the laptop project. Similar to the implementation process used in the previous year at Mott Hall, students received their computers at 'rollout' meetings where both students and parents were oriented to the laptops and the software and reviewed safety and security policies as well as maintenance issues. Although survey data were not collected during the year, the following section describes the findings of this second phase as they relate to student attendance and achievement in math, reading, and ESL skills. Please note that all analyses exclude the Mott Hall laptop students who were in their second year of the laptop program as the second phase of the laptop initiative began.

A. Student Attendance

The following section presents findings of student attendance for 1997 and 1998 based on the total number of possible days that students could have attended school. There are two types of tables presented: tables showing matched longitudinal attendance data from one year to the next year, and tables showing students' attendance on an annual basis. Because students participating in the laptop project were a subset of the total number of sixth grade students in the district, analyses were conducted comparing the laptop students to the non-laptop sixth grade population in District Six.

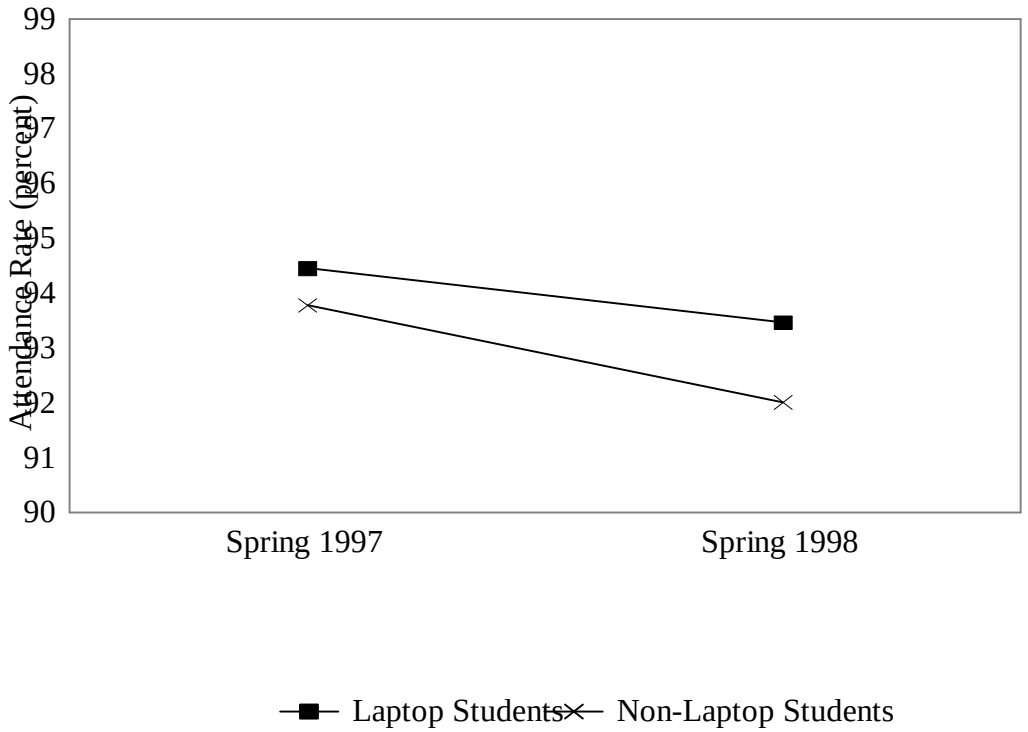
Attendance rates for laptop and non-laptop students are displayed as a percentage accounting for the number of days students attended school out of the total number of possible days students could have attended school in the 1996-97 and 1997-98 academic years. The results are shown in Table 16 and Figure 4.

Table 16
Average Daily Attendance for Laptop and Non-laptop Students
Spring 1997 and 1998

	Laptop Students		Non-laptop Students		Mean Difference
	N	ADA	N	ADA	
Spring 1997	400	94.46%	2064	93.78%	.48*
Spring 1998	426	93.47%	2124	92.01%	1.46*

*Statistically significant at or below the .05 level of probability on an independent samples *t* test

Figure 4
Comparison of Attendance Rates for Laptop and Non-Laptop Students
Spring 1997 and Spring 1998



While laptop students had significantly greater attendance rates than non-laptop students even before the implementation of the laptop program, they were able to maintain their high attendance through 1998. Laptop students had an average ADA of 94.46 percent while non-laptop students had an average ADA of 93.78 percent during 1996-97. This pattern was maintained during the 1997-1998 school year with laptop students achieving a greater ADA rate than non-laptop students (ADA of 93.47 percent and 92.01 percent, respectively).

A longitudinal analysis was conducted examining student attendance rates for students with data in both the 1996-97 and 1997-98 academic years. Table 17 displays the results for both laptop and non-laptop students.

Table 17
Longitudinal Analysis of Attendance Rates for Laptop and Non-laptop Students
Spring 1997 - Spring 1998

Sixth Grade Students in Spring 1998	N	Spring 1997 (Baseline)	Spring 1998 (First Year Laptop Program)	Mean Difference	Percent of Students Whose Attendance Increased
		ADA	ADA		
Laptop Students	391	94.49%	93.72%	-.77*	41%
Non-laptop Students	1912	93.90%	92.12%	-1.79*	41%

*Statistically significant at or below the .05 level of probability on a correlated samples *t* test

Findings from Table 17 indicate that although laptop participants had greater attendance than non-participants overall, there was a significant decrease in attendance rates for all students from the 1996-97 academic year to the 1997-98 academic year. While non-laptop student attendance rates dropped to an average ADA of 92.12 percent, laptop students attendance dropped to an average ADA of 93.72 percent in 1997-98. Only forty-one percent of both laptop and non-laptop students increased their attendance from 1997 to 1998.

B. Student Achievement: Longitudinal Study of the Project Smart Schools

The following section presents findings of analyses of reading, mathematics, and ESL achievement for 1997 and 1998, based on the annual New York City reading, mathematics, and ESL testing programs for students participating in the laptop project in District Six. Tables showing matched (pre/post) longitudinal performance from one year's testing program to the next year's testing program are displayed along with tables showing students' performance on selected measures on an annual basis. The achievement scores of the sixth grade laptop students were compared to the achievement scores of non-laptop sixth grades in the district.[4]

CAT Mathematics

[4] Excluding special education students and students retained in grade.

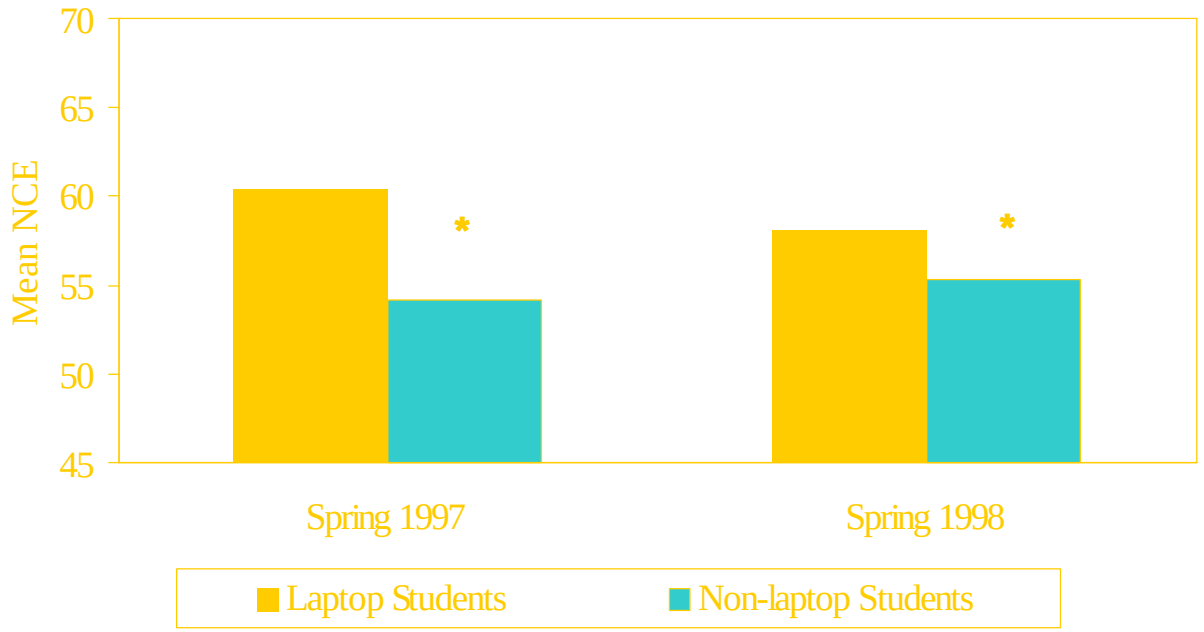
In order to assess mathematics performance, CAT scores were examined for laptop and non-laptop students. In addition, achievement scores for students who took the Spanish translated version (CTN) were analyzed separately and are displayed immediately following the CAT math information. Table 18 and Figure 5, below, display the results of analyses comparing laptop and non-laptop students' CAT math scores in Spring 1997 and Spring 1998.

Table 18
CAT Mathematics Scores for Laptop and Non-laptop Students
Spring 1997 and Spring 1998

	Laptop Students		**Non-Laptop Students**		**Mean Difference (in NCEs)**
	N	Mean NCE	N	Mean NCE	
Spring 1997	346	60.40	1454	54.18	6.22*
Spring 1998	385	58.11	1353	55.32	2.79*

*Statistically significant at or below the .05 level of probability on an independent samples *t* test

Figure 5
CAT Mathematics Scores for Laptop and Non-laptop Students
Spring 1997 and Spring 1998



As shown in Table 18, analyses revealed that laptop students performed better on the CAT than non-laptop students even before the laptop program began in 1997. Laptop students achieved an average math score of 60.40 NCEs while non-laptop students achieved an average score of 54.18 NCEs. Interestingly, this trend continued through the first year of the laptop program, with laptop students performing better than non-laptop students on the 1998 CAT (mean score of 58.11 NCEs and 55.32 NCEs, respectively).

Longitudinal analyses of matched student CAT data from Spring 1997 and Spring 1998 are displayed in Table 19.

Table 19
Longitudinal Analysis of CAT Mathematics Scores for Laptop and Non-laptop Students
Spring 1997-Spring 1998

Sixth Grade Students in Spring 1998	N	Spring 1997 (Baseline)	Spring 1998 (First Year Laptop Program)	Mean Difference (in NCEs)	Percent of Students Whose Post > Pre
		Mean NCE	Mean NCE		
Laptop Students	333	60.56	60.24	-.32	45%
Non-laptop Students	1167	55.00	56.45	1.45*	52%

*Statistically significant at or below the .05 level of probability on a correlated samples *t* test

As seen in Table 19, students in the laptop program appear to have maintained does their CAT scores: students achieved a mean of 60.56 NCEs in Spring 1997 and a mean score of 60.24 NCEs in Spring 1998. However, non-laptop students displayed a significant mean increase of 1.45 NCEs in their CAT scores between 1997 and 1998 (mean score of 55.00 NCEs and 56.45 NCEs respectively). Over 50 percent of the non-laptop students had higher CAT scores in 1998 than in 1997 as compared to 45 percent of the laptop students.

CTN Mathematics

Spanish-speaking students recognized as having limited English proficiency are entitled to take the mathematics achievement test in their dominant language. The CTN is the Spanish translated version of the California Achievement Test (CAT) math. Achievement data for students who took the CTN were analyzed separately. Table 20 displays Spring 1997 and Spring 1998 CTN results for the laptop students and their non-laptop peers.

Table 20
CTN Mathematics Scores for Laptop and Non-laptop Students
Spring 1997 and Spring 1998

	Laptop Students		Non-laptop Students		Mean Difference (in NCEs)
	N	Mean NCE	N	Mean NCE	
Spring 1997	51	41.08	521	38.50	2.58
Spring 1998	28	35.57	476	34.11	1.46

There was no difference in laptop and non-laptop students' CTN scores in either Spring 1997 or Spring 1998. In Spring 1997, laptop students scored a mean of 41.08 NCEs while non-laptop students achieved a mean of 38.50 NCEs. In Spring 1998, participants scored a mean of 35.57 NCEs and non-participants scored a mean of 34.11 NCEs.

Longitudinal analyses of CTN scores for laptop and non-laptop students from Spring 1997 to Spring 1998 are displayed below, in Table 21.

Table 21
Longitudinal Analysis of CTN Mathematics Scores for Laptop and Non-laptop Students
Spring 1997-Spring 1998

Sixth Grade Students in Spring 1998	N	Spring 1997 (Baseline)	Spring 1998 (First Year Laptop Program)	Mean Difference (in NCEs)	Percent of Students Whose Post > Pre
		Mean NCE	Mean NCE		
Laptop Students	19	37.53	38.16	.63	53%
Non-laptop Students	309	36.62	38.30	1.69	51%

Participation in the laptop program did not appear to affect students' CTN scores. Both laptop and non-laptop students maintained their performance relative to national norms from 1997 to 1998. About half of both laptop and non-laptop students scored better on the CTN in 1998 than in 1997.

CTB Reading

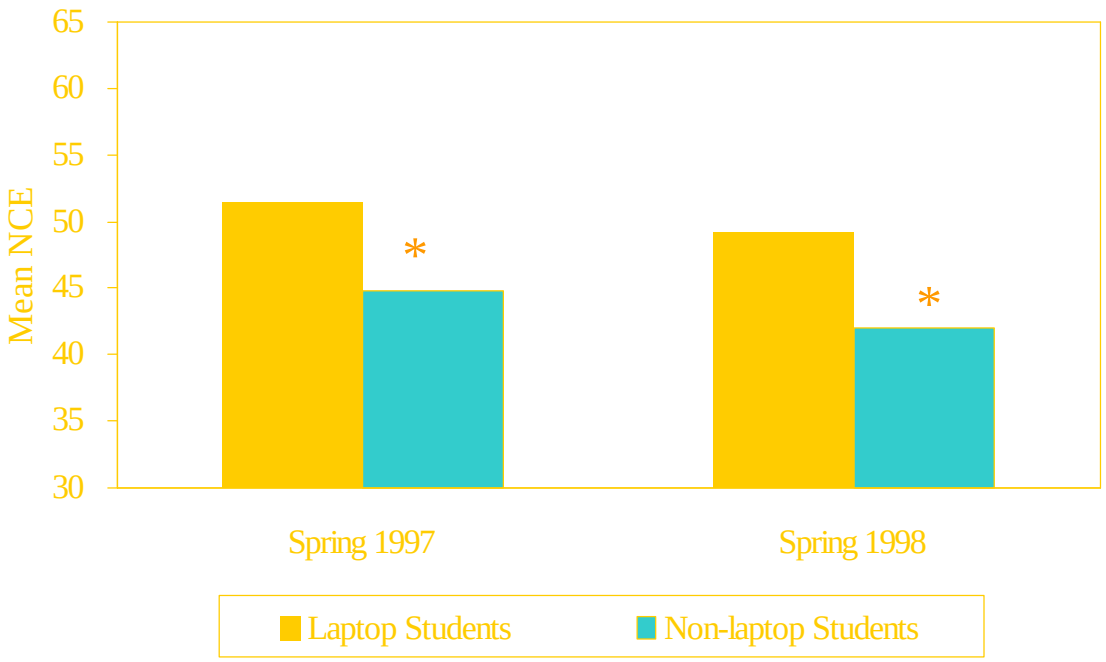
In order to measure student gains in reading performance, Spring 1997 and Spring 1998 CTB scores were analyzed. Table 22 and Figure 6 display a comparison of CTB reading scores for laptop and non-laptop students.

Table 22
CTB Reading Scores for Laptop and Non-laptop Students
Spring 1997 and Spring 1998

	Laptop Students		Non-laptop Students		Mean Difference (in NCEs)
	N	Mean NCE	N	Mean NCE	
Spring 1997	362	51.45	1618	44.76	6.64*
Spring 1998	389	49.23	1500	41.94	7.29*

*Statistically significant at or below the .05 level of probability on an independent samples *t* test

Figure 6
CTB Reading Scores for Laptop and Non-laptop Students
Spring 1997 and Spring 1998



As displayed in Table 22 and Figure 6, laptop participants scored statistically higher on the CTB test in Spring 1997 (mean of 51.45 NCEs) than their non-laptop peers (mean of 44.76 NCEs). After the first year of the laptop program, participants still achieved a greater mean CTB score than non-laptop students (a mean of 49.23 NCEs versus a mean of 41.94 NCEs for non-participants).

Longitudinal analyses of laptop and non-laptop student CTB scores were conducted for Spring 1997 to Spring 1998 and are displayed in Table 23, below.

Table 23
Longitudinal Analysis of CTB Reading Scores for Laptop and Non-laptop Students
Spring 1997-Spring 1998

Sixth Grade Students in Spring 1998	N	Spring 1997 (Baseline)	Spring 1998 (First Year Laptop Program)	Mean Difference (in NCEs)	Percent of Students Whose Post > Pre
		Mean NCE	Mean NCE		
Laptop Students	349	51.63	50.44	-1.19	44%
Non-laptop Students	1318	45.21	42.84	-2.38*	41%

*Statistically significant at or below the .05 level of probability on a correlated samples *t* test

It should be noted that a longitudinal analysis of CTB scores for all New York City sixth grade students showed an average *city-wide decline* of 4.35 NCEs on the CTB reading between Spring 1997 and Spring 1998. Longitudinal analyses examining matched CTB scores of District Six students only, as shown in Table 23, from 1997 to 1998 indicated that using a laptop computer may have helped students maintain their reading performance despite city-wide declines on the CTB. Laptop students maintained their performance between 1997 and 1998, achieving a mean of 51.63 NCEs in 1997 and 50.44 NCEs in 1998. Non-laptop students, however, experienced a significant decline in their CTB scores between 1997 and 1998, scoring a mean of 45.21 NCEs in 1997 and 42.84 NCEs in 1998.

Language Assessment Battery (LAB)

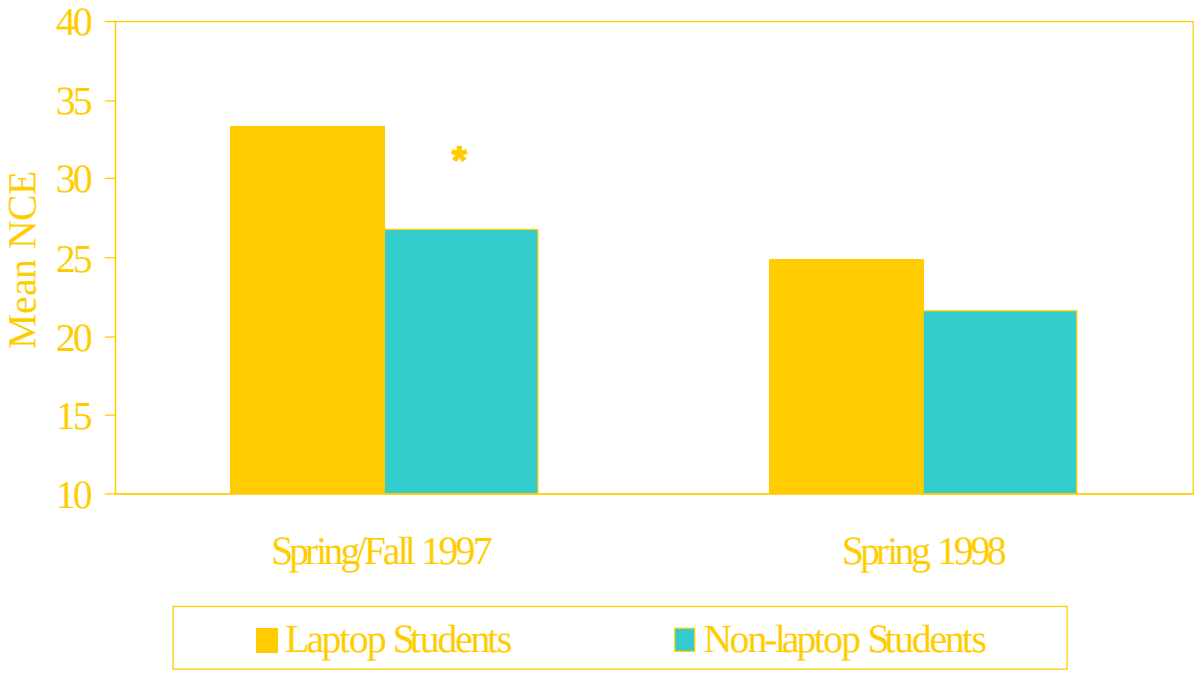
Limited English Proficient (LEP) students' English language skills were measured by the Language Assessment Battery (LAB). Table 24 and Figure 7 display LAB scores for both laptop and non-laptop students in Spring 1997 and Spring 1998.

Table 24
LAB Scores for Laptop and Non-laptop Students
Spring/Fall 1997 and Spring 1998

	Laptop Students		Non-laptop Students		Mean Difference (in NCEs)
	N	Mean NCE	N	Mean NCE	
Spring/Fall 1997	110	33.39	1012	26.75	6.64*
Spring 1998	76	24.88	631	21.61	3.27

*Statistically significant at or below the .05 level of probability on an independent samples *t* test

Figure 7
LAB: Total Language Arts Scores for Laptop and Non-laptop Students
Spring/Fall 1997 and Spring 1998



As shown in Table 24, Spring/Fall 1997 LAB scores were significantly higher for laptop students (mean of 33.39 NCEs) than non-laptop students (mean of 26.75 NCEs) during the baseline year. This trend continued throughout the first year of the laptop program. However, there was no significant difference between laptop and non-laptop students' LAB scores after the first year of the program, achieving means of 24.88 NCEs and 21.61 NCEs, respectively.

Longitudinal analyses examining matched LAB scores for LEP students in Spring/Fall 1997 and Spring 1998 are displayed in Table 25.

Table 25
Longitudinal Analysis of LAB Scores for Laptop and Non-laptop Students
Spring/Fall 1997-Spring 1998

Sixth Grade Students in Spring 1998	N	Spring 1997 (Baseline)	Spring 1998 (First Year Laptop Program)	Mean Difference (in NCEs)	Percent of Students Whose Post > Pre
		Mean NCE	Mean NCE		
Laptop Students	69	21.16	25.99	4.83*	58%
Non-laptop Students	580	19.11	22.13	3.02*	50%

*Statistically significant at or below the .05 level of probability on a correlated samples *t* test

Of the students who had matched LAB data for Spring/Fall 1997 and Spring 1998, both laptop and non-laptop students made significant gains on their LAB scores. Laptop students achieved a mean gain of 4.83 NCEs from Spring/Fall 1997 to Spring 1998. Non-laptop students scored an average of 19.11 NCEs in 1997 and 22.13 NCEs in 1998, demonstrating a mean gain of 3.02 NCEs. Fifty-eight percent of the laptop students increased their LAB scores between Spring/Fall 1997 and Spring 1998 as compared to 50 percent of their non-laptop peers.

C. Summary of Project Smart Schools Achievement Data

Phase two of the laptop initiative involved integration of the laptop computers into five District Six schools. Students and teachers in 17 classes began their first year as laptop participants. Although the classes were spread throughout the district, it should be noted that initially the students in these classes had better attendance rates and standardized test scores than the rest of the District Six student population. It is wise to exercise caution when examining the evaluation findings and comparing the laptop students their non-laptop peers, as the participants were not necessarily a random sample of the population.

Examination of student data indicated some positive findings from the laptop project. Laptop students were able to maintain their CTB reading scores while non-laptop students experienced a significant drop in reading performance between 1997 and 1998. Most significant, is the fact that laptop students maintained their CTB performance in light of an average *city-wide* decline of 4 NCEs by New York City sixth graders. It appears that participation in the laptop program, supported students' reading skills. In addition, LEP laptop students made greater gains

on the LAB than their non-laptop peers between 1997 and 1998. However, there were some less positive findings as well. Despite higher attendance for laptop students as compared to non-laptop students, both groups experienced a drop in attendance during the 1997-1998 academic year. Although all students initially displayed a relatively high ADA and the laptop students' decline was less severe than non-laptop students', it is still a point of concern. Results of longitudinal analyses of students' math scores indicate that although laptop students' maintained their math performance between 1997 and 1998, non-laptop students increased their CAT math scores. One possibility is that because non-laptop students' math performance was initially low, they may have received more intensive in-class math test preparation than the laptop students.

Nonetheless, all findings need to be interpreted with caution as the pattern of results from the Mott Hall pilot study and the Project Smart schools were not similar. However, given that the student populations are different in both evaluations, different results could be expected. Further, consider that the first year of the program involves both teachers and students learning how to use and maintain the technology, explore with the technology, and build the technology skills that will allow them to tackle increasingly challenging projects. Since teachers and students were learning the technology while simultaneously engaging in test preparation, curriculum-based projects, and daily classroom activities, it is quite promising that students even maintained or increased their achievement across all measures.

It is recommended that in subsequent years of the laptop project, the focus be less on teaching technology skills and more on building instructional skills. With the integration of laptops into even more schools in the coming years, there needs to be a shift in emphasis from concerns over access to technology and developing computer skills, to designing effective laptop curricula for all content areas and developing more advanced strategies for implementing the laptop into daily instruction. Less emphasis on the use of the tool and more emphasis on the challenge of the educational task is recommended in order to truly see gains in student achievement.

IV. Phase Three: Districtwide Expansion

In June, 1998 the New York City Central Board of Education voted to permit Community School District Six to enter into a laptop leasing arrangement with the Inacom Information Systems, Inc., and the IBM Credit Corporation. Under the terms of the contract, District Six is able to lease laptops over a thirty-six month term with a dollar buy out at the end of the lease. With the new contract in place, the laptop program is expanding to include over 700 students in the fourth, fifth, and sixth grade classes throughout the district.

In July and August of 1998, the District undertook two projects in an effort to support this next phase of laptop implementation. On a voluntary basis, beginning laptop students participated in a Laptop Summer School, while an additional 89 teachers received laptop training in preparation for the project expansion.

A. Laptop Summer School

Over 500 fourth, fifth, and sixth grade students participated in a four-week Laptop Summer School program designed to familiarize students with the laptop and software applications. These students were trained to become the 'student experts' when their classes became laptop classes during the 1998-99 academic year. These students received training in using the Microsoft Office '97 software and will be able to assist their teachers and fellow classmates in using the technology.

Student Perceptions

Participants at the 1998 Laptop Summer Program completed a survey in August 1998 in order to assess the effectiveness of using a laptop computer in school on students' attitudes, outside activities, and academic achievement. The surveys were designed so that students had the opportunity to both quantitatively and qualitatively describe their experiences with the laptops, as well as changes in their personal and academic habits since acquiring their computers.

Students read a list of activities and were asked whether or not they spend more or less time engaging in the activities since receiving a laptop computer. Table 26 examines changes in students' outside activities since acquiring a laptop computer.

Table 26
Frequency Distribution of Student Survey Responses
Laptop Summer Program - 1998

Activity	N	More Time	Less Time
Homework	207	59%	41%
Watching television	207	20%	80%
Playing with friends	208	32%	68%
Talking on the phone	208	19%	81%
Extracurricular activities	170	44%	56%
Playing video games (Nintendo, Sega)	197	16%	84%
Computer activities not related to school	201	64%	36%

As illustrated in Table 26, students reported changes in both their academic and outside activities since acquiring a laptop computer. For example, 59 percent of students replied that they spent more time doing their homework during the laptop summer program than they did during the school year. This may be due to the fact that the students were just learning how to use their laptops and therefore homework may have taken significantly more time to complete. Interestingly, students reported a great change in the amount of time spent on leisure activities. Eighty percent or more of the students responded that they spent less time playing video games, watching television, and talking on the phone since receiving the laptop. Moreover, 64 percent of students reported that they now spend more time working on computer activities not related to

school. Overall, these findings suggest that since obtaining computers in the Laptop Summer Program, students have reconstructed the nature of their free time to incorporate more academically oriented activities, leaving less time for watching television or talking on the telephone.

Students were asked to cite how often they used their laptop computers for an array of activities. A response of one indicates that the student never used the computer for the given activity, while a response of five signifies that the student always used the computer for the given activity. Thus, the greater the value of the total means, the more often students tended to use the laptop for the specific task. Table 27 presents the frequency with which students use their laptops for a variety of home and school activities.

Table 27
Mean Ratings of Students' Academic and Personal Usage of the Laptop Computer
Laptop Summer Program - 1998

I use my laptop to:	**N**	**Mean Rating**
Do my daily homework	208	4.04
Work on school projects	197	3.66
Play games	206	3.19
Help my parents learn about computers	206	3.36
Help my sibling (or family member) learn about computers	209	3.03
Help my friend learn about computers	205	2.63
Learn the software applications for myself	204	3.13
Explore the Internet	203	2.00
Create my own documents (e.g., write stories, make banners, or write letters)	206	3.59
Work with my parents on a school project	199	2.43
Work with my parents on a project not related to school	205	2.45
Work with my sibling (or friend) on their school work	189	2.37

As displayed in Table 27, students tended to use their laptop computers most often for the purpose of completing their schoolwork (homework and school projects) and creating their own personal documents. Laptop computers were 'rarely' used for exploring the Internet, most likely due to the fact that the Internet was not available in school and most children did not have access to it from home. Nonetheless, these findings indicate that the laptop computers were successfully integrated into students' daily routine and were being used for both academic and personal reasons. In addition, students sometimes helped their parents (mean rating of 3.36) and other siblings (mean rating of 3.30) learn about computers. The technology appears to have provided a link between students' academic and home environments.

Students were also asked to read statements beginning with "this summer, how often did you" and followed by a specific computer or software program task. Students responded by rating the amount of time they spent using the computer or software, on a scale of one to five, with one representing "never" and five representing 'always'. Thus a higher mean rating indicates a greater amount of time students were engaged with a program over the course of the summer. Table 28 displays students' self-assessment of their computer and software usage.

Table 28
Mean Rating of Students' Self-Assessment of Computer and Software Usage
Laptop Summer Program - 1998

This summer, how often did you:	N	Mean Rating
Take your computer home	204	4.31
Use Microsoft Word	205	3.98
Use Microsoft Excel	204	3.32
Use Power Point	202	3.34
Use Schedule +/Outlook	195	2.13
Use the accessories (e.g., calculator, paint)	199	3.16

As displayed in Table 28, students nearly 'always' took their computers home (mean rating of 4.31). Microsoft Word was used most frequently during the summer as students learned keyboarding, formatting, and letter and report writing skills. PowerPoint was also utilized by the students in the summer laptop program. Students made slides and inserted graphics and animations into the reports and papers they were writing. Students conducted a number of small surveys on a variety of topics (e.g., favorite animal, favorite movie, favorite actor/actress, and height/weight). Data from these surveys were entered into the Excel spreadsheet program which was then used to analyze the data and create bar and pie charts. Students 'rarely' used the Schedule +/Outlook program (mean rating 2.13). Overall, it appears that students received at least an introduction, if not some advanced training, in using the Office '97 software package.

The top half of Table 29 measures students' perceptions of their own academic confidence, achievement, and classroom behavior since receiving a laptop computer. The bottom half of the table presents students' self-assessment of their future plans in school, their career, and computer usage.

Table 29
Frequency Distribution of Student Attitudes Regarding School and the Future
Laptop Summer Program - 1998

Since becoming a laptop student:	**N**	**Agree**	**Disagree**
I get better grades	190	90%	10%
I learn more	210	100%	-
I am more excited about school	210	90%	10%
I have better behavior in class	208	90%	10%
When my school work is difficult, I try harder to figure it out	208	96%	4%
I help other kids	210	94%	6%
School and learning are more fun	209	92%	8%
I am a good member of my class	209	92%	8%
I think that in the future I will:		**Agree**	**Disagree**
graduate from college	208	99%	1%
work in a job with computers	206	48%	52%
work in a job I like	209	96%	4%
have a computer in my house	207	96%	4%

As displayed in Table 29, participants tended to report that since becoming a laptop student, their confidence, achievement, classroom behavior, and overall attitude toward school have improved. All of the students reported that they learn more with a laptop, 96 percent of students claimed that when their school work is difficult, they try harder to figure it out, and 94 percent of students reported that they help other students.

Interestingly, almost half (48 percent) of the laptop students reported that they think they will work in a job using computers and the majority of students believe that they will continue to have a computer in their house (96 percent). More importantly, the laptop program seems to have provided students with a sense of confidence in their academic abilities, as indicated by their future plans. For instance, 99 percent of students believe that they will graduate from college, while 96 percent of laptop participants presume that they will work in a job they like. Overall, the findings are very positive and suggest that participation in the laptop program may benefit students' motivation to learn, interest in school, self-esteem, and future career plans. The laptop program has the potential to positively influence students' short and long-term academic achievement.

B. Summary of the Laptop Summer School Data

Evaluation findings indicate that students summer laptop experiences were overwhelmingly positive. The majority of students reported spending more time on homework

during the summer than they did during the school year. In addition, results indicated that the laptop may promote student interest in schoolwork over leisure activities. Consider that over 80 percent of the summer laptop students reported spending less time playing video games, watching television, and talking on the phone than before they received a laptop computer. It also appeared that students used some of their free time to help parents and siblings learn the technology. Most importantly, using a laptop seems to affect student attitudes regarding career and future opportunities. Almost all of the students thought they would graduate from college, work in a job they like, and own a computer. The summer laptop program appears to have provided students with a firm foundation in knowledge of the technology as well as interest and motivation in learning.

V. Conclusions

Overall it appears that the District Six laptop project is quite successful. Preliminary findings indicate that students perceive great gains in their organizational and writing skills. They are more interested in school and are able to work more independently. The laptop teachers report that the quality of student work has improved and students seem more motivated and interested in learning. Student attitudes toward future goals and careers are extremely positive. Teachers also indicated that their role has become more of a knowledge 'facilitator' rather than knowledge 'provider.' Participation in the laptop program appears to have transformed teachers' instructional strategies to be more inquiry-based and student-centered.

In terms of student achievement, as measured by standardized tests, the findings are less clear. Although laptop students were able to maintain their performance and in some cases even increase their achievement, the pattern of evaluation results across Mott Hall and the Project Smart Schools was not similar. Additional evaluation techniques and supplementary measures of achievement should be incorporated in future years to help clarify the laptop's effect on student performance. In addition, it is recommended that subsequent years of the laptop project focus on designing a laptop curriculum that challenges students' technology knowledge while also stressing reading, writing, and math skills. The laptop appears to have great potential to increasingly support and foster students skills across all content areas. As the laptop program expands, emphasis should be placed on designing materials and professional development programs to support second and third year laptop classrooms. The potential of the program to revolutionize student learning appears to lie in the design of increasingly complex and challenging laptop curricula and intensive professional development opportunities for staff to gain the skills to achieve optimal results.