Evaluation of the SPARC Program: Final Report

September 2007

Prepared for:

Pennsylvania Department of Education

Prepared by:

WESTAT
1650 Research Boulevard
Rockville, Maryland 20850
301-251-1500

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Authors:

Gary Silverstein
Brian Kleiner
Amber Winkler
Xiaodong Zhang
Atsushi Miyaoka

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EXECUTIVE SUMMARY

In 2003, Pennsylvania was one of 10 recipients of the Evaluating State Education Technology Programs Grant, part of the U.S. Department of Education's Enhancing Education Through Technology Program. The purpose of this competitive grant program was to increase the capacity of states to evaluate the impact of educational technology and examine the conditions under which educational technology impacts student achievement in elementary and secondary education. Specifically:

> The Department expects that the projects it funds under this grant announcement will yield the following outcomes…A body of knowledge that can inform other States about effective methods, practices, instruments, and conditions for conducting scientifically based evaluations…In addition, the Department expects the evaluation findings that result from this competition will yield empirical evidence about the conditions and practices under which educational technology is effective in helping students meet challenging academic content standards and in increasing student academic achievement (*Federal Register,* Vol. 68, No. 112, June 11, 2003).

This report examines the implementation and impact of a home computer initiative for 5th grade students. The program, conducted with funding from the U.S. Department of Education grant, was designed to build upon similar efforts already in place in several Pennsylvania school districts. By presenting information about the study's methodology, this report is also intended to inform the efforts of other states that are interested in using an experimental design to examine the impact of an educational technology initiative.

Background

A growing body of research pointing to a positive relationship between computer use and student engagement and achievement has made the continuing digital divide a pressing concern among educators and policymakers. As a result, home computer programs intended to redress gaps in access and level the educational playing field have become more common in school districts around the nation.

In spite of the proliferation of these initiatives, few empirical studies have employed rigorous experimental designs that allow for an examination of the impact of providing students with home access to computers, and the results of existing studies that employ non-experimental designs are viewed by many as inconclusive. This report presents findings from an evaluation of a home computer intervention that used a rigorous experimental design to assess the intervention's impact on a range of student and parent outcomes.

The evaluation of the Student and Parent Access to Recycled Computers (SPARC) program was designed to assess the impact of providing refurbished computers and dial-up Internet access to the families of 5th grade students in four urban communities in eastern Pennsylvania. The 3-year study randomly assigned 355 5th grade students across 22 schools to either a treatment or control group (all of these students resided in households that reported not having a working home computer in the months prior to the intervention). During the 2004–05 school year, students randomly assigned to the treatment group received a refurbished Dell Pentium II/III computer, a printer, a pair of speakers, free dial-up Internet access through America Online, access to toll-free technical assistance, access to a website that provided links to educational sites, and the opportunity to participate in monthly training sessions about

how to make use of learning technologies. In order to provide parity, students assigned to the control group received these same benefits at the end of the 2004–05 school year.

A primary objective of the study was to examine whether the provision of home computers and Internet access (1) increases the frequency with which students use these tools for academic, informational, and recreational purposes, (2) improves students' skills at using these tools, (3) increases students' interest in school and specific academic subjects, (4) improves student performance and achievement, (5) increases parents' frequency of use and technical proficiency, and (6) increases parental involvement in their children's education. The study also explored whether there are conditions under which the provision of home computers is more or less likely to improve student achievement and/or increase parental involvement in their child's education. A secondary study objective was to document the practical issues that need to be considered when using refurbished computers to bridge the digital divide. An additional, but equally important objective was to assess the feasibility of using experimental designs to study the impact of educational interventions and develop data collection and evaluation tools for use by state and local school systems.

The use of random assignment provided a robust framework for attributing student and parent outcomes to the effects of the SPARC intervention. Within-classroom random assignment was used to ensure an equal distribution of treatment and control students in each class, thereby allowing us to control for possible confounding variables associated with the instructional practices of individual teachers. Random assignment occurred in September 2004, with 178 students assigned to the treatment group and 176 assigned to the control group.[i] Throughout the 2004–05 school year, Westat employed a wide range of data collection activities to address the study's research questions. These included pre- and post-intervention student and parent surveys, a teacher log, a teacher survey, case studies with students in one study school, and focus groups with a sample of treatment group parents. In addition, we obtained grades and standardized test assessment scores in mathematics and reading for individual study participants.

A series of factors affected both the intervention and the study design. Most notably, the length of time required to hire a full-time program director and the need to distribute refurbished computers as early in the 2004–05 school year as possible made it difficult to prepare for many of the interrelated activities that had to be implemented concurrently. In addition, the failure to recruit contiguous school districts—for reasons beyond the control of program staff—ultimately hindered efforts to provide training and technical assistance in an expedient manner. The conditions of the federal grant and the limited timeframe also affected the scope of the study design. For example, the need to recruit schools as quickly as possible precluded us from situating the intervention in schools and classrooms where students were making frequent and effective use of learning technologies.

A factor that potentially affected the extent to which treatment group participants made use of the SPARC computers was the quality of the computers themselves. One-third of treatment households reported experiencing significant technical difficulties with their refurbished computers during the 2004-05 school year. What is not clear is whether these computer-related problems were the result of low quality PCs, the refurbishing process itself, or how the computers were used by families (e.g., downloading too many software programs that diminished the PCs' processing capacity).

The recruitment process for the SPARC study was designed to identify schools with a high percentage of students who lacked access to a working home computer. It is therefore not surprising that the 22 elementary schools that elected to participate in the study were located in neighborhoods characterized by high rates of poverty and unemployment. All of the participating elementary schools

[i] There were originally 177 students in the control group. However, one control student who was found to be living in the same household as a treatment student was removed from the study sample.

were equipped with computers and Internet access. Nonetheless, it appears that the extent to which teachers made use of computers and the Internet with their 5th grade students was limited. Even more notable for the SPARC intervention, most of the teachers with students in the study were reluctant to require computer or Internet use for homework assignments because they believed that many of their students had limited access to computers outside of school.

As such, it is reasonable to characterize the SPARC initiative as a "passive" intervention—that is, treatment students took possession of their home computers without any requirement that they be used for school-related or academic purposes. On the one hand, the use of a passive intervention was not accidental in that SPARC was designed to assess the impact of a low-cost home-based technology initiative that could be replicated in other high-need communities. On the other hand, the minimal use of learning technologies in the classrooms, as well as the lack of any homework assignments that encouraged or required computer and Internet use, may have decreased the likelihood that treatment students would make use of their SPARC computers for academic purposes.

Findings

This section summarizes findings for both parents and students. The primary emphasis is on findings from the factor analysis, which was used to determine statistically whether individual items from the student, parent, and teacher surveys that appeared to be correlated with one another (from a theoretical perspective) actually belonged to the same constructs. Findings from the bivariate comparisons of individual survey items are included throughout the report.

Intermediate Student Outcomes

Although the ultimate goal of SPARC was to improve student academic performance, the program was also designed to affect a wide range of intermediate student outcomes, including increased computer use, enhanced computer skills, and increased engagement in school and learning. Indeed, it was believed that the attainment of these intermediate outcomes might ultimately enhance students' academic performance.

As is shown in Table E-1, treatment students were more likely than their control counterparts to report using computers for recreational and school-related purposes. They were also more likely to report stronger computer skills than control students. Interestingly, control students exhibited slightly more positive attitudes about computers than treatment students, although it should be noted that nearly all students held very positive views about computers. The SPARC intervention did not, however, affect students' overall interest or participation in their schoolwork, as reported by both study students and their 5th grade teachers.[ii]

Student Achievement

Although SPARC was an out-of-school intervention, a primary purpose of the study was to assess whether the provision of home computer and Internet access would have an impact on student achievement. For the purpose of the study, student achievement was defined as grades in four core

[ii] Treatment students were more likely than their control counterparts to meet or exceed classroom requirements in three areas: using multiple sources to prepare written assignments/projects, using computers and the Internet to locate and retrieve information, and using computers to present information (see Table 7-3 in Chapter 7).

academic subjects (i.e., reading/language arts, mathematics, science, and social studies) and scores in reading and mathematics on the 5th grade Pennsylvania System of School Assessment (PSSA).

Table E-1.—Comparison of factor outcomes for treatment and control students

Outcome		Treatment	Control	T-C	Effect size
Student factors *(from individual items in the May 2005 student survey)*	Frequency of computer use for school	3.26	2.74	0.53**	0.54
	Frequency of computer use for recreation	3.35	2.66	0.70**	0.74
	Computer skills	3.14	2.86	0.29**	0.28
	Computer attitudes	2.87	3.13	-0.26*	-0.26
	Interest in schoolwork	3.01	2.99	0.02	0.02
	Participation in schoolwork	2.97	3.03	-0.06	-0.06
Teacher log factor	Teacher perspective on student engagement in schoolwork	3.09	2.91	0.18	0.18

*p≤0.05, ** p≤0.01.

NOTE: Student factor scores reflect means on a 5-point scale.

SOURCE: eSPARC Post-Intervention Student Survey, 2005 and teacher log, fourth quarter 2005.

As shown in Table E-2, there were no significant differences between treatment and control students in the rescaled grades for any of the four core subject areas. Comparison of overall PSSA scale scores revealed no difference between treatment and control students for both reading and mathematics (Table E-3). In addition, there were no treatment subgroups that scored higher or lower on the PSSA as a result of their participation in SPARC (see Tables 7-27a and 7-27b in Chapter 7). These findings suggest that exposure to the SPARC intervention had no impact on treatment students' grades or performance on the PSSA.

Table E-2.—Fourth quarter rescaled grades in core subject areas for study students

Subject area and attendance	Total (N=283)	Treatment (N=140)	Control (N=143)	p-value
Reading/language arts	2.30	2.29	2.31	.77
Science	2.53	2.55	2.51	.62
Social studies	2.42	2.44	2.40	.59
Mathematics	2.23	2.26	2.19	.41
Number of days absent from school	8.58	9.24	7.92	.14

NOTE: There were no statistically significant differences between treatment and control for any of the variables in the table.

Table E-3.—Overall PSSA scores in reading and mathematics for study students

PSSA subject	Total (N=314)	Treatment (N=159)	Control (N=155)	p-value
Reading	1,149	1,142	1,158	.53
Mathematics	1,295	1,291	1,303	.64

NOTE: There were no statistically significant differences between treatment and control for any of the variables in the table.

There are several potential explanations for the lack of impact on student achievement. First, and perhaps most importantly, the SPARC intervention lacked an academic component that directly linked the home computer to any aspect of study participants' schoolwork. Second, few treatment households took advantage of the voluntary training in basic computer skills that was made available through the SPARC intervention. It is therefore likely that some treatment students lacked the incentive and skills needed to

maximize the educational potential of their home computers. Equally importantly, they may have lacked a full appreciation of how the computers could be applied to their schoolwork. As such, their educational use of the SPARC computers appears to have been limited to typing up reports and occasionally using the Internet to look up information about a subject. Third, significant student achievement outcomes were unlikely due to the short period of the intervention. Finally, many have argued that traditional grading and current standardized assessments may not be the best ways to measure the academic growth that occurs as a result of students' use of learning technologies (Becker and Lovitts 2002; Rockman et al. 2003; Quellmalz and Zalles 2002).

Parent Outcomes

Factor analysis was used to examine the relationship between individual items from the spring 2005 parent survey under the following constructs: parent computer skills, and three aspects of parental involvement—(1) helping 5th grade children with schoolwork, (2) talking with 5th grade children about school and/or hobbies, and (3) participating in activities at school. As shown in Table E-4, parents of treatment students reported stronger computer skills than their control counterparts. However, the SPARC intervention did not affect any of the three aspects of parental involvement that resulted from the factor analysis. Taken together, these findings suggest that while home access to computers and the Internet led to a significant improvement in treatment parents' computer skills, it did not compel treatment parents to be more actively involved in most aspects of their children's education. It is worth noting, however, that the SPARC intervention did result in greater parental involvement for specific interactions that required computer and/or Internet use—e.g., using the Internet to help their child with schoolwork (see Table 8-11 in Chapter 8).

Table E-4.—Comparison of factor outcomes for treatment and control parents

Outcome	Treatment	Control	T-C	Effect size
Computer skills	3.17	2.85	0.33**	0.33
Helping 5th grade child with schoolwork	2.96	3.04	-0.08	-0.08
Talking with 5th grade child about school and/or hobbies	2.90	3.09	-0.19	-0.19
Participating in activities at school[1]	3.04	2.97	0.07	0.07

** $p \leq 0.01$.

[1]Includes attending back-to-school night, chaperoning a school field trip, attending a school or class event (e.g., play or science fair), and volunteering in the school or in the classroom.

NOTE: All of the factor scores reflect means on a 5-point scale.

SOURCE: eSPARC Post-Intervention Parent Survey, 2005.

Summary and Lessons Learned

The SPARC initiative was envisioned as a low-cost and replicable approach for addressing the digital divide, establishing electronic connections between homes and schools in impoverished communities, and meeting the diverse learning needs of underserved students. The resulting evaluation was designed to assess the impact of providing 5th graders from impoverished households with a home computer and Internet access. Study findings reveal that gaining access to a home computer and the Internet significantly increased the frequency of student computer use for both school and recreational purposes. It also improved computer skills for both students and parents. Nonetheless, the study did not uncover any evidence that the SPARC intervention had an impact on students' grades or PSSA scores.

Given the myriad of factors that affected the scope of the SPARC intervention, we are reluctant to use the study's findings to cast doubt on the educational merit of providing elementary school students

with home access to computers and the Internet. However, study findings certainly suggest that absent a broader educational framework, the provision of home computers and Internet access is unlikely to lead to improved student achievement or parental involvement. At the very least, our research should serve as a warning to school districts that a "passive" home computer intervention is unlikely to yield positive effects on student achievement, student engagement, or parental involvement.

Educational initiatives looking to build on findings from the SPARC evaluation might explore the feasibility of supplementing the provision of home PCs with a dynamic in-school component that is closely aligned with regular classroom activities (or with an out-of-classroom component that is closely aligned with ongoing academic activities in core subject areas). Such an intervention might include (1) a robust educational framework emphasizing frequent in-class use of learning technologies and/or a mandatory out-of-classroom technology training component, (2) structured opportunities for the out-of-classroom use of computers and the Internet for homework and special projects, (3) home computers with enhanced reliability and functionality (e.g., more memory, faster processing speeds, and faster Internet connections), and (4) timely technical assistance.

The recommendations in Chapter 9 reflect a series of lessons learned as a result of the SPARC study regarding home computer interventions and the use of random assignment as a tool for evaluating such interventions. These recommendations are summarized in Exhibits E-1 and E-2.

Exhibit E-1.—Summary of lessons learned regarding the SPARC intervention

Using Refurbished Computers in Home-Based Educational Initiatives

- Anticipate that some cost-savings associated with the use of donated PCs may be offset by the need to refurbish the computers and provide ongoing technical support.
- Standardize the process used to refurbish computers.
- Adhere to strict quality control procedures.
- Consider utilizing professional refurbishers.

Providing Training and Technical Assistance in Home-Based Educational Initiatives

- Use multiple training sessions to educate users about the operating capacity of their machines.
- Begin voluntary training as soon after the distribution of equipment or services as possible.
- Situate after-hours training activities at a site that is easily accessible to participating households.
- Provide incentives for families to attend voluntary training sessions that occur in the evening.
- Encourage the school's principal or the child's teacher to promote supplemental training.
- Make receipt of a home computer contingent on attendance at technology training sessions.
- Target supplementary technology skills training to a specific audience.
- Anticipate the need for extensive home-based technical assistance.
- Designate staff members who are primarily responsible for providing training and technical support.

Exhibit E-2.—Summary of lessons learned regarding the study design

Establishing Realistic Timetables for Rigorous Studies • Set aside enough time prior to random assignment for planning, recruitment, and preliminary data collection. • Set aside enough time to conduct other tasks associated with the conduct of the study.
Collecting Data from Study Participants • Develop relationships with individuals at the district and school levels. • Set aside funds in the study budget for incentives. • Supplement survey data with face-to-face interviews with study participants.
Conducting Random Assignment Studies • Consider whether the intervention to be examined is ready for the costs and increased scrutiny associated with gold standard studies. • Recognize that the strength of the intervention may have to be compromised to accommodate the study design—and vice versa. • Anticipate the need to wait several years for valid and reliable study findings. • Be aware of the tension between the value-added of experimental studies and the risk of small-impact or no-impact findings**.**

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1. INTRODUCTION

In 2003, Pennsylvania was one of 10 recipients of the Evaluating State Education Technology Programs Grant, part of the U.S. Department of Education's Enhancing Education Through Technology Program. The purpose of this competitive grant program was to increase the capacity of states to evaluate the impact of educational technology and examine the conditions under which educational technology impacts student achievement in elementary and secondary education. Specifically:

> The Department expects that the projects it funds under this grant announcement will yield the following outcomes…A body of knowledge that can inform other States about effective methods, practices, instruments, and conditions for conducting scientifically based evaluations…In addition, the Department expects the evaluation findings that result from this competition will yield empirical evidence about the conditions and practices under which educational technology is effective in helping students meet challenging academic content standards and in increasing student academic achievement (*Federal Register*, Vol. 68, No. 112, June 11, 2003).

This report examines the implementation and impact of a home computer initiative for 5th grade students. The program, conducted with funding from the U.S. Department of Education grant, was designed to build upon similar efforts already in place in several Pennsylvania school districts. By presenting information about the study's methodology, this report is also intended to inform the efforts of other states that are interested in using an experimental design to examine the impact of an educational technology initiative.

Background

The number of U.S. households with access to computers and the Internet has increased dramatically over the past several decades. According to data from the U.S. Census, 78 percent of all children ages 3 to 17 lived in a household with a computer in 2003, up from 32 percent in 1993 and 55 percent in 1998. In 2003, 66 percent of children ages 3 to 17 lived in homes with Internet access.

Despite these dramatic increases in home ownership of computers, the home digital divide persists. Two factors continue to be the primary determinants of whether a household possesses a computer—race/ethnicity and household income. For example, in 2003, most White (non-Hispanic) and Asian children between the ages of 3 to 17 lived in households with computers (87 percent and 84 percent, respectively), compared to 54 percent of African American children and 55 percent of Hispanic children. With regard to household income, 2003 Census data reveal that among households earning $100,000 or more annually, 97 percent had at least one computer, compared to 47 percent of households with incomes below $25,000. In addition, 95 percent of children 3 to 17 in households earning $100,000 or more annually had access to the Internet at home, compared to 33 percent living in households earning less than $25,000 per year. The majority of White and Asian children lived in households with Internet access in 2003 (79 and 74 percent, respectively), compared to 42 percent of both Black and Hispanic children.

There is a growing body of research that points to a positive relationship between computer use and student academic performance, student engagement, and parental involvement (see the literature review in Chapter 2). This research has made the home digital divide an even more pressing concern among educators and policymakers. As a result, home computer interventions intended to redress gaps in access

and level the educational playing field have become increasingly common in many school districts. Some of these initiatives are designed to provide laptop computers (for school and/or home use) to all students in a classroom, grade, or school. Others provide students with a computer (and, in some cases, Internet access) for home use. Many of the home-based initiatives offer technical support and training to students and parents, while school-based programs generally provide teachers with professional development that aims to enhance their capacity to integrate learning technologies into their classroom curriculum.

Policymakers and practitioners alike are under increasing pressure to demonstrate the benefits of investing in educational technology. However, few empirical studies have employed rigorous experimental designs that allow for an examination of the impact of enhanced home access to computers and the Internet on students, and the results of existing studies that employ non-experimental designs are viewed by many as inconclusive. This report attempts to fill this gap by presenting findings from an evaluation of a home computer intervention that used a rigorous experimental design to assess a range of student and parent outcomes. Outcomes of interest included frequency of computer use, computer skills, school engagement, student academic performance, and parental involvement.

Overview of the SPARC Study and Research Questions

The evaluation of the Student and Parent Access to Recycled Computers (SPARC)[1] program was an experimental study designed to assess the impact of providing refurbished computers and dial-up Internet access to the families of 5th grade students in four urban communities in eastern Pennsylvania. The 3-year study randomly assigned 355 5th grade students to either a treatment or control group (all of these students were from households that reported not having a working home computer in the months prior to the intervention).[2] During the 2004–05 school year, students assigned to the treatment group received a refurbished Dell Pentium II/III computer, a printer, a pair of speakers, free dial-up Internet access through America Online, access to toll-free technical assistance, access to a website that provided links to educational sites, and the opportunity to participate in monthly training sessions about how to make use of learning technologies. In order to provide parity, students assigned to the control group received these same benefits at the end of the 2004–05 school year.

A primary objective of the study was to examine whether the provision of home computers and Internet access (1) increases the frequency with which students use these tools for academic, informational, and recreational purposes, (2) improves students' skills at using these tools, (3) increases students' interest in school and specific academic subjects, (4) improves student performance and achievement, (5) increases parents' frequency of use and technical proficiency, and (6) increases parental involvement in their children's education. The study also explored whether there are conditions under which the provision of home computers is more or less likely to improve student achievement and/or increase parental involvement in their child's education. A secondary study objective was to document the practical issues that need to be considered when using refurbished computers to bridge the digital divide. An additional, but equally important objective was to assess the feasibility of using experimental designs to study the impact of educational interventions and develop data collection and evaluation tools for use by state and local school systems.

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[1] The original proposal to the U.S. Department of Education referred to the proposed intervention as both SPARC and eSPARC (for evaluation of Student and Parent Access to Recycled Computers). Throughout this report, we have chosen to use SPARC, since that term refers to the actual intervention that was the subject of this evaluation. Also, as is discussed in Chapter 4, although SPARC was an abbreviation for Student and Parent Access to Recycled Computers, the PCs that were provided to study participants were actually *refurbished*, that is, they had undergone some form of testing, troubleshooting, cleaning, repair, and/or maintenance.

[2] One control group student who was found to be living in the same household as a treatment group student was removed from the study sample. For the remainder of the report, we refer to the 354 students in study population, rather than 355.

Throughout the 2004–05 school year, Westat employed a wide range of data collection activities to address the study's research questions. These included a household recruitment survey, pre- and post-intervention student and parent surveys, a teacher log and a teacher survey, case studies and focus groups, as well as the collection of grades and standardized test assessment scores for individual study participants.

Organization of the Report

The remainder of this report provides information about the implementation and impact of the SPARC intervention. It also provides information about the context within which the intervention and the study were conducted. Specifically:

- Chapter 2 presents an extensive literature review that is designed to place the SPARC intervention and study within the context of what is known more broadly about the use and impact of educational technologies.

- Chapter 3 provides a detailed account of the SPARC intervention and study design.

- Chapter 4 identifies a combination of factors that affected the implementation of both the SPARC intervention and the corresponding evaluation. It also provides data on the range of problems that treatment households reported encountering with their SPARC computers and dial-up Internet access.

- Chapter 5 describes the characteristics of the study population, including information about the characteristics of the students and parents who participated in the study, and how the households of study participants compared to other households of students in the school that reported having a home computer. It also provides information about the extent to which study participants' 5th grade teachers were making use of learning technologies in the classroom.

- Chapter 6 examines the extent to which treatment students and parents took advantage of the services made available through the SPARC intervention. It also provides students' and parents' opinions of the benefits of gaining home access to a computer and the Internet.

- Chapter 7 examines the impact of the SPARC intervention on students' computer/Internet use and skills. It also assesses the extent to which SPARC affected student engagement and achievement.

- Chapter 8 examines the impact of the SPARC intervention on parents' computer/Internet use and skills. It also assesses the extent to which SPARC affected parental involvement in their 5th grader's education and hobbies.

- Chapter 9 describes lessons learned regarding the SPARC intervention and the study design. It is intended to inform the efforts of practitioners and evaluators who are looking to implement similar interventions or studies.

Appendix A provides more detailed information about the methodology used to analyze the data obtained from various sources. Appendix B contains additional statistical tables. Appendices C through J provide the data collection protocols that were used to conduct the study.

2. REVIEW OF LITERATURE ON THE USE OF COMPUTERS AND THE INTERNET TO ENHANCE EDUCATIONAL OUTCOMES

The SPARC intervention and study design were intended to build upon and expand the existing base of research on the use of learning technologies to improve student achievement and enhance parents' involvement in their children's education. Therefore, at the outset of the study, we conducted an extensive literature review that examined previous research in several areas, including (1) student access to and use of computers and the Internet in school and at home; (2) how learning technology impacts computer literacy, student engagement, student achievement, and parental involvement; and (3) how previous learning technology interventions have been implemented and evaluated. Throughout the evaluation, we continued to review new studies in each of these areas to ensure that decisions about the conduct of the study reflected emerging discoveries about the educational uses and impacts of learning technologies.

This chapter presents findings from our review of the literature. The primary purpose is to provide a detailed summary for those readers who are interested in the strengths and limitations of previous studies on the educational benefits of computer and Internet use. A secondary purpose is to document the underlying concepts that informed the design and conduct of the study. Findings presented in this chapter primarily reflect studies conducted in the past decade on access to and use of computers and the Internet among students and adults, as well as the impacts of learning technologies on elementary and secondary students in the United States.

Student Access to and Use of Computers and the Internet

Most school-age children in the United States now have some degree of experience with computers and the Internet. According to the U.S. Census Bureau, nine out of 10 school-age children used a computer either at home or at school in 2003, with only 7 percent not using a computer in any location (Day, Janus, and Davis 2005). Sixty-four percent of school-age children used computers both at home and at school, while 24 percent used computers only at school. In 2003, 77 percent of children ages 10 to 14 used the Internet at home, while 53 percent (of those enrolled in school) used the Internet at school.

School Access

In 1994, only 3 percent of public school instructional rooms had access to the Internet. By 2005, that proportion had increased to 94 percent (Wells and Lewis 2006). Similarly, the ratio of public school students to instructional computers with Internet access has improved over time. In 2005, the ratio of students to instructional computers with Internet access in public schools was 3.8 to 1, significantly lower than the 12.1 to 1 ratio in 1998. There is also evidence that some of the disparities between public schools in low- and high-poverty neighborhoods has diminished. For example, in 2005, the ratio of students to instructional computers with Internet access was roughly similar in public schools with the highest and lowest poverty concentrations (4.0 to 1 compared to 3.8 to 1).

Home Access

While access to computers and the Internet has become nearly universal in schools across the nation, that is not yet the case with regard to home access. Nonetheless, the number of U.S. households with access to computers and the Internet has increased dramatically over the past several decades. For

example, Census data show that the number of households with a computer increased from 8.2 percent (9 million households) in 1984 to 62.0 percent (70 million households) in 2003 (Day, Janus, and Davis 2005). The same data reveal that 78 percent of all children ages 3 to 17 lived in a household with a computer in 2003, up from 32 percent in 1993 and 55 percent in 1998. In 1997, 18 percent of households had Internet access, compared to 55 percent in 2003. Further, in 2003, 66 percent of children ages 3 to 17 lived in homes with Internet access.

Despite these dramatic increases in access to computer technology, significant gaps remain. Two factors—race/ethnicity and household income—continue to be the main determinants of whether a household possesses a computer.[3] For example, in 2003, most White and Asian children between the ages of 3 to 17 lived in households with computers (87 percent and 84 percent, respectively), compared to 54 percent of Black children and 55 percent of Hispanic children. With regard to household income, 2003 Census data show that among households earning $100,000 or more annually, 97 percent had at least one computer, compared to 47 percent of households with incomes below $25,000. These findings are consistent with data from the National Center for Education Statistics, which found that children from low-income families, particularly those at the lowest grade levels (i.e., kindergarten and first grade), were least likely to have access to home computers (Rathburn and West 2001).

Even greater disparities exist with respect to the Internet, perhaps because of the additional monthly costs required to maintain home access. According to 2003 Census data, 95 percent of children 3 to 17 in households earning $100,000 or more annually had access to the Internet at home, compared to 33 percent living in households earning less than $25,000 per year. In addition, the majority of white and Asian children lived in households with Internet access in 2003 (79 and 74 percent, respectively), compared to 42 percent of both Black and Hispanic children.

Patterns of Computer Use

As discussed in the previous section, the student-to-computer ratio (the most widely accepted measure of school access) and the proportion of households that possess a computer have both improved steadily over the past decade. However, data from multiple studies have demonstrated that increased *access* to learning technologies does not always translate to increased *use* of learning technologies. This section summarizes findings from previous studies on patterns of computer and Internet use by students in both the classroom and at home.

Computer Use at School

There are some indications that the degree of use has not increased as steadily or as consistently as levels of access, at least with respect to use within the schools (Cuban 2001; Russell et al. 2003). This research demonstrates that although computers are used in school, the amount of time for which they are used is severely limited. As Russell, Bebell, and Higgins (2004, 2) suggest, two explanations are often provided for why computer use has increased at a slow rate relative to the increase in access:

> The first explanation focuses on the need to prepare teachers to integrate technology with their instructional practices… the second explanation focuses on challenges presented by the ways in which computers are distributed within

[3] Several additional determining factors exist. For example, households in the southern region of the United States and those situated in central cities or in rural areas were less likely to have a computer in 2003. Furthermore, two-parent households were more likely than single-parent households to own a computer.

a school setting. Despite relatively low student to computer ratios, in many middle and high schools computers are removed from the classroom and are instead located in labs and the library, which make access during class time difficult.

According to findings from a study of 4th through 12th grade teachers by Becker (2001), frequent student experiences with school computers occur for the most part in four contexts: separate computer courses, pre-occupational preparation, exploratory uses in elementary school classes, and the use of word processing software for students to present work to their teachers. Among elementary school teachers in self-contained classrooms, about two-fifths reported roughly weekly use of computers. Becker found that several factors influenced the extent to which teachers used computers with their students, including whether or not a sufficient number of computers were located in their classroom, the extent to which teachers felt pressured to cover large amounts of curriculum, and teachers' lack of expertise with using computers.

Becker also examined the reasons teachers provided for having students use computers in their classrooms. He found that computer-using teachers most commonly cited three general objectives: (1) information-gathering objectives, such as "finding out about ideas and information," (2) constructivist objectives such as "expressing oneself in writing," and (3) skills-related objectives, such as "mastering skills just taught." Further, teachers at schools with lower income student populations were far more likely to use computers for remediation and simple reinforcement of skills than teachers in other schools, and were less likely to have other kinds of objectives.

A recent national survey of K–12 teachers revealed that while more than half of all teachers (56 percent) said that computer technology changed how they teach "a great deal," almost two-thirds thought that there were too few computers in their classrooms for effective teaching, and slightly over one-half said that they integrate technology into their daily curriculum (CDW-G 2005). Also, many teachers said that available professional development focused on administrative rather than instructional functions. Thus, they felt unprepared to integrate educational technology into their instruction—only 25 percent of teachers said that they felt adequately trained to use today's instructional software packages. According to this report, "…specific training on integrating technology with teaching seems to be falling through the cracks" (p. 3).

Computer Use at Home

A number of studies have examined both the frequency of use of computers in households, as well as the types of things for which they are used. According to 2003 Census data, 91 percent of children ages 10 to 14 with home computers used them. A study from the Annenberg Public Policy Center reported that children ages 2 to 17 in homes with computers spent about 1.5 hours using them per day (Stander and Gridina 1999). The same study reported that children still watched almost twice as much television each day than they used computers. In a study of home computer use in 22 Massachusetts school districts, researchers found that 57 percent of 5th graders spent an hour or less each day on their home computer, while 29 percent spent between 1 to 2 hours, and 14 percent spent over 2 hours per day (Russell et al. 2003). Finally, a study of Internet use by children ages 2 to 17 (Grunwald Associates 2003) found that one in five children logged onto the Internet at home every day for educational purposes, although the Internet was used for a variety of other purposes by children, including exploration (surfing and searching), communication (instant messaging, e-mailing, and chat rooms), and entertainment (games, music, and videos).

In a study of computer use among children in low-income and middle-income households, Ba, Tally, and Tsikalas (2002) found that all study participants used their home computers for schoolwork, and many spent several hours a day communicating with peers, playing games, and pursuing hobbies. They also found that children from low-income families had different patterns of computer use than those from middle-income families. Specifically, children in low-income homes tended to use their computers more for educational purposes, since the household was more likely to have a single computer located in a shared space, where computer use could be monitored by an adult. However, children from middle-income homes were more likely to use their computers for recreational purposes (in part because they had access to a computer in their bedroom). Study participants in low-income homes were also more likely to rely on formal help providers and schoolteachers for technical assistance, compared to middle-income children who relied more on themselves, their families, and their peers.

An ethnographic study of home computing by Giacquinta et al. (1993) found that most children played games and avoided educational software. Attewell et al. (2003) also found that young children with a home computer spent about 3 hours per week playing games and only about 30 minutes a week on educational activities. Census data from 2003 showed that among children ages 10 to 14, 85 percent used their home computer to play games, 84 percent for school assignments, 74 percent for connecting to the Internet, 56 percent for word processing, and 52 percent for e-mail (Day, Janus, and Davis 2005).

Research suggests that in addition to household income, a number of other factors can influence how computers are used in the home (Ba, Tally, and Tsikalas 2002; Russell et al. 2001; Frohlich and Kraut 2002). For example, Russell et al. (2001) found that the amount of access students had to a computer at school was related to the degree to which they used computers at home. Moreover, they found that students in classrooms in which a laptop was provided for each individual student reported using their home computers slightly more frequently for personal activities and significantly more frequently for schoolwork than students who shared a computer with others (despite nearly universal home access to technology). According to the authors, "It appears that students who were provided with permanent access to a laptop in school not only use computers more frequently in the classroom, but also use computers at home for school related purposes more frequently than students in the shared laptop classrooms" (p. 13).

Other research suggests that the extent to which teachers use computers during class time is predictive of their students' continued use of computers to perform school-related tasks outside of the classroom. For example, Tsikalas and Stock (2001) and Rockman et al. (1998) found that the extent to which students used their home computers for education-related purposes was associated with whether their teachers assigned computer-based homework. Becker (2000a) found that home computer use appears to increase when teachers have their students use computers to find information and to communicate electronically, and when they give students frequent opportunities to use word processing software during class time.

There are indications that age and grade level also determine computer use patterns in the home. Russell et al. (2003) found that more 8th graders used a computer at home than 5th or 11th graders—63 percent of 8th graders reported using a computer at home for an hour or more each day, compared to 55 percent of 11th graders and 43 percent of 5th graders. Further, these numbers remained consistent with respect to the rates at which students used computers at home specifically for school purposes—just over 50 percent of 8th graders used computers at home more than once a week to write papers for school, compared to 24 percent of 5th graders and 40 percent of 11th graders.

A number of studies (Subrahmanyan et al. 2001; Bernt et al. 2003; Canada and Brusca 1992; Hale 2002) found that although boys and girls tend to use computers at similar rates with regard to school assignments, boys were more likely to use computers for playing games and girls were more likely to use

them for e-mail and chat purposes. While Tsikalas and Stock (2001) did not find any significant differences between boys and girls with respect to home computer use, they did conclude that students with parents not fluent in English tended to use their home computers more often for homework, word processing, and e-mail than those with parents fluent in English.

Earlier research points to other factors that may influence the use of computers at home. Dutton, Rogers, and Jun (1987) noted that those involved in a social network of computer users may use computers more and for a larger number of applications. Caron, Giroux, and Douzou (1989) found that families lacking experience with computers had high expectations about their potential benefits, but tended to primarily use them for playing games and learning about basic computer functions than families with greater experience with computers. Another study by McQuarrie (1989) found intensity and breadth of home computer use to be related to the quality of the home computer and to the experience and capacity of the user, as well as the ways in which the computer is used for interaction and social integration.

Impact of Computers and the Internet

As computer access and use have increased to unprecedented levels in the United States (along with spending on educational technology), policymakers, educators, and researchers have increasingly recognized the importance of evaluating the extent to which computers benefit students, teachers, and families. A great deal of study has been devoted to assessing the impacts of computer technology on student achievement, as well as on other aspects of student life that are viewed as likely to promote learning and achievement, including student engagement, computer literacy, and parents' involvement in their children's education.

While there is widespread agreement that learning technologies have the *potential* to boost student achievement, existing research on the educational impacts of computer and Internet use reveals mixed and inconclusive findings. In addition, studies that have uncovered positive findings have generally concluded that such gains in student learning can only be ascribed to the use of learning technologies *under certain conditions*. As such, a review of the literature suggests that it is inappropriate to proclaim the benefits or detriments of learning technologies without also describing the context within which they are used. These conditions are often highly complex and involve variables at multiple levels, such as student characteristics (individual and social), teacher and classroom characteristics (e.g., teacher experience, attitudes, and practices, classroom size), school characteristics (such as technology infrastructure and curriculum), and parent and household characteristics (e.g., income and education level, extent of exposure to computers, degree of parental involvement in student learning).

With respect to the impacts of computer use, existing research generally focuses on four main areas: student engagement (e.g., interest and motivation in school), computer literacy, student achievement and learning, and parental involvement. Our review of the research is organized around these four areas.

Student Engagement

Student engagement is often viewed as playing a key role in student achievement and other learning outcomes. Fredricks, Blumenfeld, and Paris (2004) describe three broad subtypes of engagement that have been employed in the literature—behavioral, emotional, and cognitive. Behavioral engagement is commonly defined as positive conduct or displays of involvement, including effort, persistence, concentration, attention, asking questions, and contributing to class discussion. Emotional engagement

commonly is defined as students' affective reactions in the classroom, such as showing interest, boredom, sadness, and anxiety. Others have defined it as identification with school, wherein students feel belonging and value. Cognitive engagement is often defined as psychological investment in learning or self-regulated learning strategies.

Numerous studies that have used these measures have reported increases in student engagement as a result of computer use. Most notably, an investigation of the relationships between home computer use and academic engagement by Tsikalas (2004) showed that students who spent more time on their home computers also worked harder in class (regardless of prior performance level) as rated by their teachers. (For related findings, see also Tsikalas and Gross 2002; Tsikalas, Gross, and Stock 2002.)

A 2004 study by Knezek and Christensen found that seventh grade students (in a single school in Maine) *without* home access to a computer scored lower than students with home access on several engagement measures, including attitudes toward school. It should, however, be noted that the study did not take into consideration other factors (e.g., household income) that may have been predictors of this result. Another study that examined the impact of providing laptops in classrooms to elementary school students found that students in one-to-one laptop classrooms had higher levels of motivation than students in other classrooms (Russell et al. 2004). Further, an examination of the Buddy System Project (an initiative that placed computers in the schools and homes of 4th, 5th, and 6th graders in Indiana) found that parents reported their children's grades improved and that their enthusiasm for completing homework increased (Duffy and McMahon 1999). (For related results on similar programs, see also Gardner 1994; Rockman 1998; Russell, Bebell, and Higgins 2004.)

According to Tsikalas, Gross, and Stock (2002, 15), gaining access to a home computer can fulfill the need of low income youth for autonomy, belonging, and competence:

> In satisfying these needs—particularly through subjective experiences of computer-related sharing, pride, learning, and receiving of information—participants are more likely to experience beneficial outcomes. Some of these positive outcomes are directly related to school (e.g., investment in education and attitudes about schoolwork and themselves as students); some are powerfully related to students' predispositions to future, self-directed learning (e.g., increases in curiosity, confidence, and control).

Other research concerning the impacts of computer use define the term "engagement" somewhat more broadly. For example, Sandholtz, Ringstaff, and Dwyer (1994) define engagement by variables such as "initiative, self-motivation, independent experimentation, spontaneous collaboration and peer coaching, and enthusiasm or frustration," as well as on-task behavior in the classroom and time spent on projects both in and out of the classroom. In a qualitative study utilizing data from 32 elementary and secondary teachers (in five schools across four states), the authors reported that the introduction of technology into the classroom brought about numerous changes in student engagement:

> Students displayed increased initiative by going beyond the requirements of assignments, and by independently exploring new applications. The time students spent on assignments and projects increased when they used the computers, and they chose to work on the computers during free time and after-school hours. Students' independent experimentation at the computer led to spontaneous peer coaching and cooperative learning. Increased student enthusiasm facilitated their learning and reinforced teachers' efforts. The enthusiasm of individual students also motivated other students in the class (p. 19).

Finally, a few studies have attempted to measure the effects of computers on engagement by examining school attendance and enrollment. Fairlie (2003), in a quantitative analysis of data from the 2001 Current Population Survey, found that school enrollment among teenagers was positively associated with owning a home computer, controlling for other factors, such as household income and parental education. Specifically, Fairlie found that slightly more than 95 percent of children with home computers were enrolled in school, compared with 85 percent of children who lacked home access to a computer (see also Stevenson 1998).

Computer Literacy

The prevalence of computers and the Internet in the workplace suggests that basic computer literacy is an important outcome that needs to be considered when examining the potential impacts of learning technologies. According to Eisenberg and Johnson (2005, 1), computer literacy means not just knowing how to operate computers, "but to use technology as a tool for organization, communication, research, and problem solving." As such, they advocate integrating computer skills into content areas and information problem-solving processes, rather than teaching computer skills in isolation.

Ba, Tally, and Tsikalas (2002) define computer literacy broadly as a set of habits that include five dimensions: troubleshooting strategies, purposes, common tool skills, communication literacy, and web literacy. Their comparative study, which focused on emerging computer literacy for children in low- and middle-income households with computer and Internet access, shows that computer literacy developed as a function of a wide variety of conditions in the home, including length of time children had a computer at home, the location and number of computers in the home, parents' attitudes toward computer use and skills with computers, the technical expertise of family, friends, and neighbors, and the direct instruction provided by teachers in the classroom.

Finally, some researchers have taken a serious look at the impacts of computer games on student learning and computer literacy. For example, Subrahmanyam et al. (2001, 13) suggest that some games may be of benefit to students: "The suite of skills children develop by playing such games can provide them with the training wheels for computer literacy, and can help prepare them for science and technology, where more and more activity depends on manipulating images on a screen…". In a study that involved students designing games for younger students to learn mathematics, Kafai (1996) concluded that learning about technology and programming supports other types of learning.

Student Achievement and Learning

The prevalence of research on student achievement is a reflection of the fact that many education-related policy and funding decisions are based on the ability to predict success in school. Moreover, sound empirical research on the impact of computer use on student achievement and learning is somewhat limited. Much of the research to date has been largely anecdotal in nature, and in many cases researchers have failed to consider the effects of household income and other factors, which, as outlined above, have an influence on how computers are used. Among studies that attempt to control for such variables, conflicting results exist as to whether or not computer use has a significant positive impact on students' academic performance.

Research on the impact of computer use at school. A growing body of research indicates that specific computer applications (e.g., drill and practice software) may improve children's performance in reading, writing, basic mathematics, and other subject areas (Fadel and Lemke 2006). For example, a report by Ringstaff and Kelley (2002, 4) concludes that "… a variety of meta-analyses conducted between

1985 and 2000 on the impact of CBI (computer based instruction), CAI (computer-assisted instruction), ILS (Integrated Learning Systems), drill-and practice software, and computer tutorials on student achievement report that students using computers had higher test scores, typically as measured on standardized achievement tests."

An evaluation of the impact of an in-class educational technology intervention on middle school science students (Horejsi and Strickland 2004) found a statistically significant improvement in treatment group student scores on a post-test in geology. A study of 290 teachers and 950 5th graders in West Virginia (Mann et al. 1999) found that a basic skills/computer education program had positive effects in schools where the program was most intensively integrated. Such schools showed statistically significant gains in Stanford 9 reading, writing, and math test scores, as well as in National Assessment of Educational Policy (NAEP) scores.

However, several studies that examined results from large-scale surveys of schoolchildren generally found that the impact of learning technologies was negative or insignificant. For example, in examining NAEP data, Wenglinsky (1998) found that eighth grade students who used computers more frequently at school had lower mathematics test scores than students who used computers less often (after controlling for family background). A subsequent study using NAEP data examined the effects of computer use on reading skills and found no significant effects (Johnson 2000). A recent study of the effectiveness of reading and mathematics software products (Dynarski et al., 2007) uncovered no statistically significant impacts on test scores after one year.

A qualitative study of a smaller number of schools by Cuban (2001) found that the use of computers in schools rarely had a substantial impact on children's learning, mainly because computers are not used frequently in the classroom but tend to be used by teachers for administrative and planning purposes. Cuban concluded that computers do not have a strong impact on student learning because most teachers have difficulty making use of them in their daily teaching.

Research on the impact of computer use at home. There is a growing body of research that points to a positive relationship between home computer use and student academic performance. Attewell and Battle (1998), using data from the 1988 National Educational Longitudinal Survey (NELS), provide evidence that student test scores and grades were positively related to home computer use (even after controlling for differences in several demographic characteristics). This study found that students with home computers consistently scored several points higher than students without home computers. A more recent study by Attewell, Suazo-Garcia, and Battle (2003) found that children who used home computers for less than 8 hours per week had significantly higher scores on measures of letter-word recognition, reading comprehension, and mathematics calculation problems than children without home computers.

Another longitudinal study that tracked a group of students from 7th through 12th grade found that the students with computers at home had higher overall grades and better grades in math and English than those without home computers (Rocheleau 1995). The study also showed that even among those with home computers (i.e., students primarily in the upper household income brackets), heavier users performed better academically than light users; students who reported using their home computers for at least 10 hours during the school year for activities unrelated to a class also reported better overall grades, better grades in math and English, and did better on a test of scientific knowledge than those who reported using their home computer less (see also Blanton et al. 2000).

Some researchers have found home computer use to be a better predictor of student achievement than school use of computers. Examining individual and schoolwide student-level measures of achievement (based on the Iowa Test of Basic Skills and the Test of Academic Proficiency), Ravitz,

Mergendoller, and Rush (2002, 4-5) found that home computer use had a greater impact than school use on students:

> …students who score better on standardized achievement tests are those who use computers more often at home, and less at school. This suggests again that home use, not school use is associated with greater achievement….More extensive users at home score higher on standardized tests and more extensive users at school score lower on standardized tests, even when we split the file by SES quintiles.

Jackson, von Eye, and Biocca (2003) found similar results. Their study of 143 low-income children participating in the HomeNetToo project (an initiative designed to provide students with home Internet access) found that greater use of the Internet at home was correlated with higher subsequent GPAs and better performance on standardized tests of reading skills: "…the more sessions the child engaged in, the higher his or her GPA, even after controlling for the effects of race on GPA."

Finally, at least one study has shown negative results. A recent analysis by Fuchs and Woessman (2004) revealed that when family background and school characteristics were controlled for, there was a large negative relationship between student achievement (in math and reading) and access to a home computer. The authors speculated that:

> …the mere availability of computers at home seems to distract students from learning, presumably mainly serving as devices for playing computer games. Only by using computers in constructive ways can the negative effect of computer provision on student learning be partly compensated for.

Parental Involvement

It is generally acknowledged that there is a positive correlation between parental involvement and student achievement (Ascher 1998; Caplan et al. 1997; Collins et al. 1995; Catsambis 1998; Epstein and Connors 1992; Maynard and Howley 1997; Samaras and Wilson 1999). Some researchers have pointed out that parent/family involvement at home has a greater impact on children than parent/family involvement in school activities at school (Christenson and Sheridan 2001; Hickman, Greenwood, and Miller 1995).

With respect to computer use, some research indicates that home computers enhance parents' involvement in their children's learning and education. For example, Rockman et al. (2003) found that schools with universal laptop programs reported greater parental involvement, at least for the first few years of the program. In addition, they suggest that home computers may have wide-ranging impacts on parents: "Because parents can learn along with their children in laptop programs, these efforts may also promote economic growth, helping parents master technology and obtain better jobs while helping communities move from the rust belt to the information economy" (p. 26).

In a meta-analysis of 19 research studies published between 1995 and 2000, Penuel et al. (2002) examined the use of home computer-based technology in relation to home to school communications. In addition to finding modest increases in student reading and math ability, and substantial increases in student writing ability, the authors found significantly improved communications between parents and schools.

Research on Home Computer Interventions

Home computer interventions, where students are furnished with a PC or laptop for home use, are increasingly common. In many cases, computers (usually laptops) for school and home use are provided to all students in a classroom, grade, or entire school. In other cases, students are given desktop computers for home use. Students and parents are often provided with technical support, training, and other resources to augment their increased access to computers and the Internet, while teachers are frequently provided professional development in how to integrate these learning technologies into their classroom curriculum.

For example, Computers for Youth (CYF) serves low-income families from selected middle schools in New York City. CYF's *Take IT Home NY* program provides home computers and other services to participating families to enhance students' interest in learning and promote parental involvement. As of December 2005, it had provided approximately 5,000 families and teachers with computers and trained more than 10,000 would-be users. CFY operates a help desk (staffed by disadvantaged youth) to give technical assistance to computer recipients and trains selected students to service CFY computers brought to the schools by families. CFY also offers a website and a training program for families. Families and teachers are required to participate in one half-day training session where they learn basic computer skills.

Another example is The Buddy Project in Indiana, initiated in 1988, which provided personal computers, printers, modems, and Internet connections to all families in selected 4th and 5th grade classrooms. Parents received extensive training in technology, and participating teachers received increased access and preparation for using educational technology in their classrooms. Teachers were encouraged to assign computer-related homework. In 2000, the Buddy Project morphed into Buddy^2, shifting focus from technology itself to using technology for learning and improving academic achievement, with an emphasis on writing (Lemke and Martin 2004).

Evaluators have identified a variety of conditions for home computing programs to be successful. Kafai et al. (2002) argue that technological infrastructure is probably the most likely challenge to such programs. Even if the computers provided to families are of good quality, consistent technical support is required. Ba, Tally, and Tsikalas (2002) recommend especially that low-income families participating in home computer programs be given adequate technical support, since they may be less able to troubleshoot problems. Maintaining Internet access can also be problematic, especially for low-income households. Other problems include program sustainability and lack of buy-in from parents. In addition, due to lack of training and experience, many students and parents are not able to take full advantage of computers and the Internet for educational purposes.

While home computer interventions are generally assumed to benefit students and justify the substantial investment required, many districts and other organizations that fund them look for evidence that such programs will have a measurable impact on student academic performance, as reflected in standardized test scores. Rockman et al. (2003, 25) note that, "as policymakers and community members increasingly focus on rigorous assessment and adequate yearly progress to drive instructional decisions, support for ubiquitous laptops may be tied to these scores." Clearly, the informed weighing of costs and benefits, with respect to student achievement, is of great importance to those considering allocating funds to such programs.

Methodological Issues Regarding Research on the Impact of Learning Technologies

Some critics of existing research on the impacts of educational technology point to the lack of rigorous study designs (e.g., Cuban 2001). Some fault the use of inadequate or inappropriate tools of measurement (e.g., Becker 2002). Others take issue with the relatively small sample sizes and insufficient study length (Krendl and Clark 1994), and others criticize the lack of true control groups for many studies that simply compare pre- and post-program outcomes (Noll et al. 2004). Other problems cited in the literature include involvement of the researchers in the intervention and lack of control for demographic variables and other factors. In a meta-analysis of studies on educational technology and student achievement, Waxman, Lin, and Michko (2003) examined almost 200 studies between 1997 and 2003. They found that most of the quantitative studies within that period lacked sufficient methodological rigor for inclusion in their meta-analysis, suggesting "…a serious problem of research in the field" (p. 13).

As a consequence of this criticism, researchers have begun to give more thought to what constitute best practices for the study of educational technology and its outcomes. Haertel and Means (2000), synthesizing recommendations from experts on best research designs on educational technology, identify three themes: (1) the need for new assessment approaches for measuring outcomes, (2) the call for better measures of implementation and content, and (3) the advantages of conducting coordinated or clustered studies.

With respect to the first of these themes, while Haertel and Means recognize that standardized tests will continue to be called upon to assess the impacts of computers on students, they recommend including such tests as part of a broader array of outcome measures collected in evaluations. There appears to be consensus among educational technology researchers that standardized assessments generally do not include adequate measures of learning outcomes that result from the use of technology, such as critical thinking, writing, and problem solving (Becker and Lovitts 2002; Rockman et al. 2003; Quellmalz and Zalles 2002). Becker and Lovitts (2002, 13) state:

> Indeed, the range of outcomes that might be evaluated in a study of the effects of computer-based experiences on students' "achievements" is so broad as to seem almost limitless. Yet it is that very breadth that raises the question of why the particular matrix of skills and factual knowledge commonly tested in existing assessments should have any privileged status when evaluating educational technology's "effect."

As for the second theme, Haertel and Means stress that studies should examine carefully the circumstances under which interventions may be effective. This includes comprehensive measures of intervention implementation. Similarly, O'Dwyer et al. (2005) note that research intended to gauge the impact of educational technology on student learning must first demonstrate understanding of how teachers and students use technology and then employ valid and reliable measures of those uses.

Indeed, the consensus among researchers devoted to the study of educational technology appears to be that measurement of impact is difficult because such technologies are not effective by themselves, but rather are effective only under certain conditions. Ringstaff and Kelley (2002, 23-24) note that "…measuring the impact of technology use on student achievement is fraught with difficulties….Perhaps, rather than asking, 'Is technology worth the cost?' the more important question is, 'Under what conditions does technology have the most benefits for students?'" Along the same lines, Coley (1997, 10) reasons that "The impact of technology is too multifaceted for such a simple question [Does it work?], which cannot be answered without considering the impact on students' learning and motivation; classroom dynamics, including interactions among students, teachers, and technology." Rumberger (2000) suggests

use of a variety of tools, such as surveys, observations, interviews, and teacher logs, for measuring implementation.

Given the weaknesses of traditional study designs for examining broader questions on the impact of educational technology on student learning, some have called for more rigorous designs, such as random assignment (Haertel and Means 2000). Randomized experiments allow testing of counterfactuals (what would have happened to a treatment group had it not experienced an intervention) under highly controlled conditions. Proponents of random assignment argue that experiments have greater validity than alternative designs with respect to obtaining evidence of causal effects, and also have greater credibility in scholarly and policy communities.

Random assignment studies in education have been rare, primarily because of the practical challenges of imposing experimental conditions in real school settings. Detractors argue that alternative designs, such as quasi-experiments and case studies, are more suitable for school contexts. Some have noted more generally that random assignment studies are too costly and time-consuming and may suffer when implementation is compromised over time or when treatment or control groups undergo extensive attrition, which may bias results (Haertel and Means 2000).

The U.S. Department of Education is currently funding a variety of national and smaller scale studies on the impact of educational technology, several of which are using random assignment to isolate the effect of computer and Internet use on students' engagement and learning. The evaluation of SPARC represents one such study and may serve as a test case for the viability of conducting random assignment studies on educational technology interventions.

Summary

Numerous studies from the past decade have demonstrated that the use of computers at school and at home can have a positive effect on student engagement, computer literacy, and perhaps parental involvement. However, the link between computer use and student achievement has yet to be established. There are several explanations for this mixed bag of results. First, there have not been enough rigorous research studies that focus on the educational impacts of increasing students' exposure to computers and the Internet. In the absence of a critical mass of studies that employ experimental or quasi-experimental designs, it is simply not possible to state conclusively that there is a direct link between the use of learning technologies and increased student achievement.

A second (and related) explanation is that the impact of computer technology on student achievement is difficult to measure. This is because computer access and use (in the school or at home) is only one of many factors (e.g., teacher quality, class size) that may contribute to student achievement. In addition, the presence of other educational reforms can make it difficult for evaluators to distinguish the impact of learning technologies from other classroom practices that are designed to produce similar outcomes. Further, an abundance of research demonstrates that non-school-related factors (e.g., socioeconomic status, parental involvement) can also influence student performance and achievement. However, many of the studies that have examined students' use of learning technologies have failed to take into account or control for such factors.

A third explanation is that the use of standardized assessments as the yardstick against which student achievement is measured has made it more difficult to detect the type of educational gains one would expect from the use of learning technologies. However, the use of alternative measures to assess specific technology skills (or students' capacity to appropriately use computers or the Internet to research a given topic or solve a specific problem) can be expensive and difficult to administer. In addition, the

pressure that policymakers and educators are facing to demonstrate Annual Yearly Progress (for No Child Left Behind) will likely keep evaluators focused on the extent to which educational initiatives that rely on learning technologies are leading to improvements on standardized assessments.

In reviewing the description of our evaluation methodology (in Chapter 3), it is worth noting that to the extent possible, decisions regarding the study design were informed by findings from the literature review. Specifically, every effort was made to develop an experimental study that would enable us to isolate the impact of a home computing initiative on student performance and achievement. Further, the range of data that were collected over the course of the study allowed for an examination of external factors that could potentially enhance or diminish the initiative's impact for specific subsets of students and parents. And while grades and standardized assessment scores were used as a primary indicator of student achievement, steps were taken to use surveys, teacher logs, and an alternative performance assessment to explore whether the SPARC intervention led to an improvement in a number of computer and Internet skills.

There is a need for information about the practical and methodological considerations that must be considered when evaluating the use of computers and the Internet to enhance educational outcomes. Chapter 9 provides some lessons learned about both the SPARC intervention and the study design that are intended to inform the future efforts of policymakers and evaluators who seek to examine the educational impact of classroom and home-based technology initiatives.

3. OVERVIEW OF THE SPARC INTERVENTION AND STUDY DESIGN

The SPARC intervention and evaluation were intended to build upon and expand the base of existing research on educational technology described in Chapter 2. Equally important, the evaluation represented an opportunity to examine the feasibility and impact of an intervention that could be replicated in high need communities—i.e., providing students from low-income households with refurbished computers, dial-up Internet access, and a limited amount of technical assistance and training. Beyond examining the efficacy of such initiatives, the purpose of the SPARC study, as described in the original proposal to the U.S. Department of Education, was to "produce a model to assist local and state educational agencies to measure the impact of technology initiatives":

> The Pennsylvania Department of Education (PDE) will facilitate a regional technology intervention, SPARC, that focuses on increasing in-home access to computers and the Internet, particularly for "high need" families, in an effort to bridge the "digital divide." PDE, local educational agencies, and several state organizations that donate refurbished computers will work collaboratively to provide home computers, Internet access, and technical assistance to a study sample comprised of 400 5th grade students and their families. By coordinating this technology intervention, PDE is creating an environment conducive to scientifically based research (e.g., random assignment, isolation of variables) in an effort to produce valid study findings and reliable evaluation methodologies and tools that may be implemented in diverse circumstances.
>
> While SPARC seeks to impact student achievement, enhance parental involvement, and increase accountability at a local level, the evaluation will (1) explore a wide range of research questions that focus on whether and how in-home computer and Internet access impact students and parents, allowing for the promotion of "what works," and (2) produce and disseminate research methodologies and tools that will assist in measuring the impact of technology initiatives across program areas, strengthening local and state evaluative capabilities.

The SPARC evaluation used an experimental design to assess the impact of providing refurbished computers and dial-up Internet access to the families of 5th grade students in four urban communities in eastern Pennsylvania. At the outset of the study, a survey was administered to the families of all 4th grade households in schools that had agreed to participate in the evaluation (i.e., households with students who would enter 5th grade the following school year). A total of 354 families that did not have a working computer at the time the survey was administered were ultimately enrolled in the study. During the 2004–05 school year, the students assigned to the treatment group received a refurbished Dell Pentium II/III computer, a dial-up Internet account, and access to a range of training and technical support services. Students assigned to the control group received these same benefits at the end of the 2004–05 school year.

A logic model developed during the initial planning phase of the SPARC study delineated a range of potential parent and student impacts that might result from the provision of refurbished home computers and dial-up Internet access. As shown in Exhibit 3-1, this model illustrated how the combination of inputs (further delineated in Exhibit 3-2) and activities (further delineated in Exhibit 3-3) brought about by the SPARC intervention would lead to a wide range of student and parent outcomes.

It should be noted that the model also provided examples of several contextual factors (further delineated in Exhibit 3-4) that could potentially affect study findings—most notably the extent to which 5th grade teachers made use of learning technologies with their students. As is discussed in this chapter and throughout this report, SPARC was viewed as an out-of-classroom intervention. As such, there was no expectation that teachers with study participants in their classes would change their instructional practices or emphasize the use of learning technologies.

While this logic model is an oversimplification of the actual intervention and study design (and includes several outcomes that were ultimately dropped from the study), it served the purpose of providing stakeholders (e.g., Pennsylvania Department of Education, participating school districts and schools) with a visual representation of the activities that were expected to occur as a result of the SPARC project and the changes or results that SPARC was designed to achieve. It also served as a framework for describing the underlying theory of change for the SPARC intervention, as well as the range of research questions and corresponding data collection strategies that would be needed to assess the full range of changes implied by the theory of change. Including the logic model in this chapter allows us to refer readers to the original framework for understanding the relationship between the project's activities and the intended results.

This chapter describes the various services that were made available to treatment households through the SPARC intervention. It then lays out the study methodology for assessing the impact of SPARC—with an emphasis on the selection of the study sample, the collection of study data, and the analyses that were used to isolate post-intervention differences between the students that were randomly assigned to the treatment and control groups.

The SPARC Intervention

The original proposal for the SPARC intervention emphasized the provision of refurbished computers and dial-up Internet access to 5th grade students who resided in a household that lacked a working home computer. This section describes the benefits made available to treatment households and the challenges that were encountered in the implementation of the SPARC intervention. Additional information about the functionality of the refurbished computers that were provided to treatment households, and the extent to which treatment families actually utilized the range of services made available through SPARC, is provided in Chapters 4 and 6.

Exhibit 3-1—Logic model for the SPARC Program

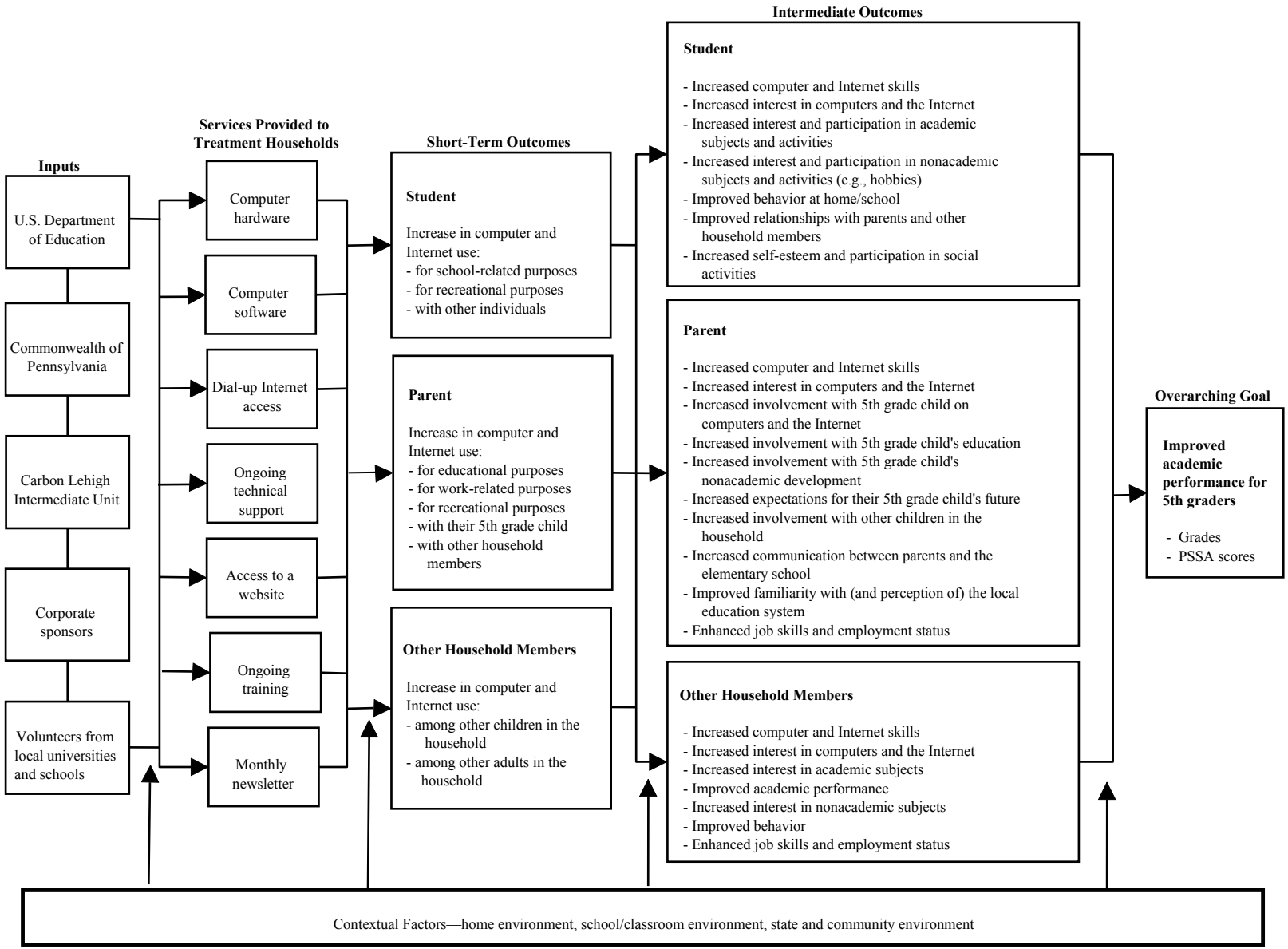


Exhibit 3-2.—Inputs for the SPARC logic model

- **U.S. Department of Education**
  - Provide funding
  - Provide guidance
- **Commonwealth of Pennsylvania**
  - Provide funding
  - Provide guidance and technical assistance
  - Obtain and coordinate resources
- **Carbon Lehigh Intermediate Unit**
  - Set up and distribute computers
  - Repair computers and provide technical assistance
  - Provide training
  - Develop/maintain website
  - Prepare newsletter
  - Provide other resources
- **Corporate Sponsors**
  - Donate computers
  - Donate other hardware
  - Donate software
  - Donate Internet access
- **Volunteers from Local Universities and schools**
  - Set up computers
  - Assist with initial training
  - Conduct ongoing training
  - Assist with technical assistance

Exhibit 3-3.—Activities for the SPARC logic model

- **Provide Households with Computer Hardware**
  - Dell Pentium II/III computers with CD-ROM
  - Monitors (17 inch)
  - Mouse and keyboard
  - Printers
  - Speakers
- **Provide Households with Computer Software**
  - Microsoft Operating System 2000 Pro
  - Microsoft Office XP
  - Scholastic Keys
  - KidBiz3000
  - netTrekker
- **Provide Households with Dial-up Internet Access**
  - AOL Internet and e-mail (2 years)
- **Provide Households with Ongoing Technical Support**
  - Resolve problems with computers
  - Enhance technical skills of individual families
- **Provide Households with Access to a Website**
  - Provide information about SPARC
  - Provide technical tips and useful websites
- **Provide Households with Ongoing Training**
  - Computer basics (for 5th grade students)
  - Internet safety (for parents)
  - Basic Internet and e-mail
  - netTrekker
  - KidBiz
  - Scholastic Keys
  - Using computers for resume writing
- **Provide Households with a Monthly Newsletter**
  - Provide information about SPARC
  - Provide technical tips and useful websites

Exhibit 3-4.—Contextual factors for the SPARC logic model

- **Home Environment**
  - Household income
  - Parents' highest level of educational attainment
  - Language spoken most at home
- **School/Classroom Environment**
  - Student access to computers and the Internet during the school day
  - Student use of computers and the Internet during the school day
  - Teachers' educational philosophy regarding computers and the Internet
  - Teachers' requirements for using computers and the Internet for homework assignments
- **State and Community Environment**
  - NCLB requirements
  - Number of free community access sites for computers and the Internet

Services Provided to Treatment Households

In October 2004, treatment families received their refurbished computers and participated in a mandatory introductory training session. Throughout the 2004–05 school year, treatment families were entitled to request technical assistance (via a website and a toll-free hotline) and participate in a series of voluntary training sessions that focused on individual computer topics. Each of the benefits made available to treatment households is described below.

Hardware and software. In late September 2004, all treatment group families received a refurbished Pentium II/III computer and dial-up Internet access.[4] As shown in Exhibit 3-5, the computers were outfitted with CD-ROM and floppy disk drives, as well as a range of management and educational software—including Windows 2000, Microsoft Office XP, and Scholastic Keys (a software program designed to provide elementary-level students with a child-friendly interface and educational enhancements for Microsoft Word, Excel, and PowerPoint). The computers were equipped with anti-spyware and anti-virus programs, as well as several plug-ins (Flash, Shockwave) and drivers (modem, printer). Households also received a new desk jet printer and speakers.

[4] The benefits described in this section only pertain to treatment families during the 2004–05 school year. While control families received similar hardware and software during the 2005–06 school year, the specifications of the refurbished computers and dial-up Internet access were slightly enhanced to reflect lessons learned from the initial rollout to treatment households. Although households did not have to return their refurbished computers, Internet access was only provided through SPARC for 2 years. Students who left the participating school during the study period were permitted to keep their computers, but their Internet access was discontinued.

Exhibit 3-5.—Hardware and software provided to treatment group households

Hardware

- Refurbished Dell Pentium II/III computer
  - 733 processor
  - 12 gigabytes
  - 125-256 RAM
  - CD-ROM and floppy disk drives
- Desk jet printer
- Speakers

Software

- Windows 2000
- Microsoft Office XP
- Scholastic Keys
- Symantec Anti-Virus
- Ad-Ware
- Spybot
- Plug-ins (Flash, Shockwave)
- WinZip
- Adobe Acrobat
- Drivers (modem, printer)
- America Online (version 9.0)

The computers were secured through a partnership with the Dell TechKnow program, an initiative designed to provide underserved students an opportunity to earn a home computer and learn technology skills.[5] As shown in Table 3-1, the 255 Pentium II and Pentium III computers acquired by the program ranged in price from $67 to $89 per unit. The program's relationship with Dell also enabled the Pennsylvania Department of Education to secure free Internet access for SPARC households through America Online and discounted copies of Microsoft Office XP and Windows 2000. Additionally, a partnership with Tom Snyder Productions enabled the program to provide Scholastic Keys to each SPARC household. The program purchased 125 monitors from a Pennsylvania-based, nonprofit refurbishing agent (at a cost of $25 per unit), and an additional 400 monitors were donated to SPARC by the Parkland Area School District. A Hewlett Packard DeskJet 3520 printer, TRENDnet 56K modem, and a set of USB-powered speakers were also purchased for each household.

[5] The Dell TechKnow program is a 40-hour, self-paced, hands-on course where students work on a Dell refurbished desktop computer in teams to learn computer basics. Upon completion of the program, students who successfully demonstrate various computer and Internet-related competencies are given the refurbished computer at no cost. In addition, students sign a contract committing to good school attendance, a demonstrated improvement in grades, and good citizenship. Parts of the mandatory training program that treatment students were required to attend were adapted from Dell TechKnow materials.

Table 3-1.—Treatment group computer specifications and unit costs

Computer specification	Quantity	Cost per unit
Dell Desktop PII 400	26	$67.00
Dell Desktop PII 450	97	72.00
Dell Desktop PIII 500	73	79.00
Dell Desktop PIII 550	20	83.00
Dell Desktop PIII 600	39	89.00

SOURCE: Carbon Lehigh Intermediate Unit.

The computers were delivered to the Carbon Lehigh Intermediate Unit in August 2004 and temporarily warehoused until the final loading instructions were approved. At that point, approximately half of the CPUs were sent to the Lehigh Career and Technical Institute, where high school students who were enrolled in a computer maintenance class worked to clean the machines, install additional hardware (e.g., modems), and complete the necessary software installation (see Table 3-2 for treatment group software specifications). The remaining machines remained at the Carbon Lehigh Intermediate Unit and were prepared for the treatment group rollout by staff. Because the project received several different types of CPUs, additional effort was needed to customize the refurbishing process for each computer model. The overall refurbishing process took approximately 3 weeks to complete. The setup and costs for the final computer system is detailed in Table 3-3.

Table 3-2.—Treatment group software specifications and unit costs

Software specification	Cost per unit
Windows 2000	$5.00
Microsoft Office XP	5.00
Scholastic Keys	5.00
Symantec Anti-Virus	12.80
Ghost license for imaging	8.70
Service pack updates for software	NA
Related software drivers	NA
America Online CD, software to be installed by participants	NA

NOTE: NA (not applicable) refers to software for which the SPARC initiative did not incur a cost.
SOURCE: Carbon Lehigh Intermediate Unit.

Table 3-3.—Treatment group computer setup with peripherals

Component	Cost per unit
Dell computer	$89.00 (avg.)
Monitor (125 purchased)	25.00
Monitor (400 donated)	NA
Mouse	NA
Keyboard	NA
Power cables	NA
Speakers	4.50
HP DeskJet 3520 printer and cable	40.24
Ream of printer paper	4.00
Microsoft Office XP software bundle	5.00
America Online CD	NA
Mouse pad	1.80

NOTE: NA (not applicable) refers to components for which the SPARC initiative did not incur a cost.
SOURCE: Carbon Lehigh Intermediate Unit.

Mandatory introductory trainings. Prior to taking home their SPARC computers, students and at least one parent from each household were required to attend separate training sessions. The purpose was to assure that treatment parents and students had at least some knowledge of basic computer skills and could set up a computer workstation at home. Training occurred at students' elementary schools, with parents attending weeknight sessions conducted by the SPARC director and students attending an all-day workshop conducted by a team of teachers from their school. When possible, local teachers served as lead facilitators for the training sessions. These teachers received their preparation through a train-the-trainer model.

The first training, a 2-hour session for parents dedicated to online safety and parental awareness, was offered to families several evenings over the course of the week prior to the distribution of computers. At least one parent/guardian was required to attend this session. The training provided an overview of basic Internet safety through facilitator-led instruction, discussions, video clips, games, and activities. The goal was for participants to leave this session with a basic understanding of the need for proper online safety, especially concerning student use. It also included tips on how to use the Internet to access various educational websites, e-mail teachers, and supervise children's use of the Internet. During these sessions, parents received an overview of the program's policies governing appropriate uses of the equipment provided through the study and signed a contract with the Pennsylvania Department of Education acknowledging that computers could be confiscated and Internet access cancelled if there was proof that (1) the computer was being used to access pornography, inappropriate matter, or materials harmful to minors; and/or (2) the computer was being used to conduct illegal activities.[6]

The second training was offered on a Saturday in early October 2004. This session was only mandatory for participating students, although parents/guardians were encouraged to attend. The curriculum for the full-day session provided participants with an overview of their computers' setup and operation. Students connected the tower to its peripherals, toured the desktop, and completed a series of exercises and activities using the SPARC-installed software to demonstrate their newly acquired computer knowledge. Specific topics included (1) how to set up the computer at home and access the Internet, (2) how to care for the computer, (3) how to make use of the software packages installed on the computer, (4) how to use and care for a printer, (5) how to navigate the Internet, (6) how to create e-mail addresses and effectively use e-mail, and (7) how to obtain technical assistance through the project. At the end of the training, students whose parents had completed the safety and parental awareness training took possession of their SPARC computers. In cases where a parent had not attended the 2-hour training, the computer was withheld until a makeup session was completed.

During the training, students received instructions about how to create their free Internet account with America Online (AOL). These directions specified that households should use the username and password that were affixed to the plastic shrink wrap for the CD-ROM when creating their AOL account (which guaranteed them 1 year of free Internet access). However, a number of treatment households inadvertently threw away the shrink wrap and used the username and passwords that came with AOL's instructions for the CD-ROM (which only provided free Internet access for a 30-day trial period). As a result, approximately 25 to 30 percent[7] of treatment households required additional assistance to modify their AOL accounts so that they could receive a full year of free Internet service.

[6] The contract also stipulated that parents/guardians would be responsible for all matter and activities associated with computer use—and that national, state, and local educational entities and partner organizations would not be responsible for any actions conducted by the computer user.

[7] Not shown in tables. Estimate provided by staff from the Carbon Lehigh Intermediate Unit.

Ongoing training. In addition to equipping treatment households with a refurbished home computer and dial-up Internet access, the SPARC intervention was designed to provide study participants with ongoing training and technical assistance. The sessions, which were initiated in November 2004, were designed by the SPARC director at the Carbon Lehigh Intermediate Unit. Sessions were held on weeknights in elementary schools in each of the participating districts. They were generally facilitated by in-district personnel and covered computer-related topics such as Internet basics, word processing, and NetTrekker (an Internet search engine designed specifically for children and their parents). As is discussed in Chapter 6, only a few treatment group families took advantage of these voluntary opportunities.[8]

Troubleshooting computer-related issues. Ongoing technical assistance was provided to treatment households through a bilingual (English and Spanish) toll-free helpline that study participants could use to ask basic questions and report problems with their SPARC computers. In the case of malfunctioning computers, technical assistance was available to repair or replace the equipment. Technical assistance home visits were also conducted with families that were unable to solve technical problems on their own. In cases where a problem was determined to be too difficult to repair, the computer was swapped out for another refurbished computer.

During summer 2005, the Carbon Lehigh Intermediate Unit provided treatment households the opportunity to have their SPARC computers serviced. This tune-up, which required that parents relinquish their SPARC computers for several weeks, was designed to address the slow processing speeds reported by a number of treatment households. The repairs were made throughout August 2005, with computers being returned to families before the beginning of the 2005–06 school year. In most cases, the computers were completely overhauled, a process that involved reinstallation of the operating system and all software programs.

SPARC website. In fall 2004, the Carbon Lehigh Intermediate Unit launched an SPARC website for treatment group families and the general public. The website (http://www.pa-eSPARC.com) was primarily designed to provide participating families with an online resource for staying informed about upcoming SPARC events, solving common technical support issues, exploring relevant websites, and finding appropriate contact information. Exhibit 3-6 provides an example of the online resources that were made available to treatment families; Exhibit 3-7 provides an example of frequently asked questions (FAQs) that were posted on the SPARC website.

Throughout the 2004–05 school year, the website was regularly updated with training calendars, technical support information, program resources, and monthly newsletters. During the 2004–05 school year, the SPARC website recorded over 4,000 hits.

[8] In order to address the low turnout to the ongoing training sessions, treatment families were provided with three computer-based training modules. These interactive, animated tutorials covered a series of topics and were delivered to participants on CD-ROM throughout 5th and 6th grades. Complete with audio playback control and corresponding text in both English and Spanish, the training modules allowed treatment families the opportunity to learn new skills at home. The modules focused on such topics as e-mail, Google, and Scholastic Keys (e.g., how to use the software program's word processing, database, slide show, and painting features). However, it should be noted that these modules were provided to treatment families *after* the intervention period covered by this impact study—and therefore are not considered among the various services that were made available as part of the SPARC intervention.

Exhibit 3-6.—Links to online resources for treatment students and parents that were identified on the SPARC website

Student Links

- www.yahooligans.com: A great way to search and find what you need. Yahooligans is a kid-friendly version of yahoo.com.
- www.discoveryschool.com: Provides information for parents, teachers, and students. Includes educational games and homework helpers.
- www.kids.gov: A site that has information and links for a variety of topics from animals to the government.
- www.beritsbest.com: Links to the 1,000 best websites for kids. Also offers ways to get homework help and meet new friends safely.
- www.americaslibrary.gov: From the Library of Congress, this site allows children to access history in a fun and educational way.
- www.factmonster.com: An online almanac, dictionary, encyclopedia, and homework help all in a kid-friendly site.
- www.encyclopedia.com: This site is a bit more advanced, but does offer a dictionary, thesaurus, and encyclopedia.
- www.aaamath.com: Devoted to all areas of mathematics. Offers games and worksheets by subject or grade level.

Parent Resources

- www.yahoo.com: A search engine with easy links to information about sports, weather, news, etc.
- www.google.com: The Internet's most popular search engine.
- www.netsmartz.org: An interactive, educational safety resource website that teaches kids and teens how to stay safer on the Internet.
- www.mapquest.com: Allows users to find directions to locations all over the U.S. Also provides door-to-door driving directions.
- www.weather.com: The weather channel's website. Has 10-day forecasting, and allows you to track the weather hourly.
- www.webmd.com: A compilation of health information all in one place. Also offers message boards, chat rooms, and "ask the Dr."
- www.monster.com: A site devoted to helping people find jobs. If you sign up, you can post your resume online and apply for jobs on the spot.
- www.colorincolorado.org: A site for Spanish-speaking parents to encourage reading and writing with their children.

SOURCE: SPARC website (http://www.pa-esparc.com).

Exhibit 3-7.—Example of technical support provided on the SPARC website

Frequently Asked Questions: Technical Support	
Q:	My computer is not working. What should I do?
A:	We're here to help you. Please contact us and we will work with you to get your computer up and running again.
Q:	For how long will we have free Internet access through AOL?
A:	Each eSPARC family will have their free AOL accounts for two years.
Q:	How many screen names can I have through my AOL account?
A:	You may have up to seven screen names through your AOL account. To add more: • Connect to the Internet through AOL. • In the white center address bar, type "screen names." • From the menu, select "create new screen name." • Follow the on-screen directions. • You will be asked to type in the new screen name along with a password. • You may also adjust the parental controls to set the accounts levels. • Once you sign on again, you will be able to select the new screen name.
Q:	Why would I want more than one screen name?
A:	Having more than one screen name gives your family more flexibility while online. Because your AOL screen name also serves as an e-mail address, having one for each member of your family is an easy way to keep e-mails separated. IMPORTANT: Parents should always know the screen name and passwords for their account in order to be able to log in and review what each person has been doing.
Q:	Am I allowed to install new software onto my computer?
A:	Yes! You may install any and all programs onto your machine. Remember, however, that different programs can affect the way your computer performs.
Q:	Microsoft Office recently stopped working. What can I do to get it back to normal?
A:	This is an easy problem to fix. • Connect to the Internet through AOL. • Open Microsoft Word. • Wait for the activation pop-up window to appear. • If it does not appear, click "Activate" under the "Help" menu on the top of the screen. • Choose to activate Office using the Internet. • Follow the on-screen directions. • When asked, select "United States" for country and click "finish." • You may have to close and reopen Word. • Congratulations! Your copy of Office is now activated and ready for unlimited use!

Exhibit 3-7.—Example of technical support provided on the SPARC website (continued)

Frequently Asked Questions: Technical Support	
Q:	Pop-ups are driving me crazy!!! What can I do?
A:	Pop-ups can cause major headaches. There are three things you can try: • Sign in to AOL. • Type "Pop ups" in the keyword bar in top of the screen. • Be sure that the "suppress pop ups" option is checked. • You may also choose to stop AOL member pop-ups, too. • If so, at the bottom click on "Suppress AOL member-only special offers." • Double click on the "Start" menu. • Double click on "settings." • Double click on "Control Panel." • Double click on "Administrative Tools." • Double click on "Services." • Scroll down to and double click on "Messenger." • Select "disabled" under Startup Type. • Click "stop" under Service status. • Service status should now say "stopped." • Click OK.
Q:	My printer is not printing properly. What can I do?
A:	Try the following: • Click Start in the bottom left hand corner. • Click Programs. • Click Accessories. • Click System Tools. • Click Disk Cleanup. • Select that you wish to clean up the C drive and click OK. • Wait for the disk drive to be analyzed. • In the window that appears next, place a check mark next to ALL of the possible choices. • Click “Yes” to confirm deleting the files. • Please be patient as the system cleans up your disk drive. • This may take several minutes.

Exhibit 3-7.—Example of technical support provided on the SPARC website (continued)

Frequently Asked Questions: Technical Support	
Q:	My printer is printing, but the pages come out blank or hard to read. What can I do?
A:	Your ink cartridges probably need to be changed. • Your printer uses two ink cartridges, one for color and one for black. • It's important that you purchase the correct ink cartridges for your printer. • Not all ink cartridges work in all printers. • If you need to replace your color cartridge, you will need HP Ink # 28. • If you need to replace your black cartridge, you will need HP Ink # 27. • Once you have your new ink ready to go, you will be placing it into the printer. • Make sure your printer is plugged in and turned on. • Open the printer's top lid. • The ink cartridge holder should slide to the center after a few seconds. • Remove any old ink cartridges from the printer by pulling the ink down and back. • It will pop out. • Using the sticker on the bottom side of the lid as a guide, place the new ink in the printer. • Be sure to place the correct ink in the correct spot. • Once the ink is in correctly, it will snap into place. • Close the lid and follow any on screen directions to calibrate the ink with the printer.

SOURCE: SPARC website (http://www.pa-esparc.com).

SPARC newsletters. Participating treatment group families received a series of newsletters in both English and Spanish between December 2004 and September 2005. Typical topics included notification of training dates and topics, tips and tricks, troubleshooting guides, frequently asked questions, and important news. Specifically:

- The December 2004 newsletter publicized an upcoming training session on netTrekker, solicited requests for training topics, provided information on two websites for children (www.kidsdomain.com and http://school.discovery.com/students), provided information about the SPARC website, and provided a tip on how to capitalize letters and use tabs to indent five spaces.

- The February 2005 newsletter provided an update of what was new on the SPARC website, provided information about two websites for children (www.pdictionary.com and www.factmonster.com), publicized an upcoming SPARC training session on KidBiz, and provided tips on how to use the SPARC computer as a calculator.

- The March 2005 newsletter provided tips on how to prevent pop-ups while using the Internet and creating multiple America Online screen names.

- The April 2005 newsletter provided tips on how to address common printer problems and cut and paste text.

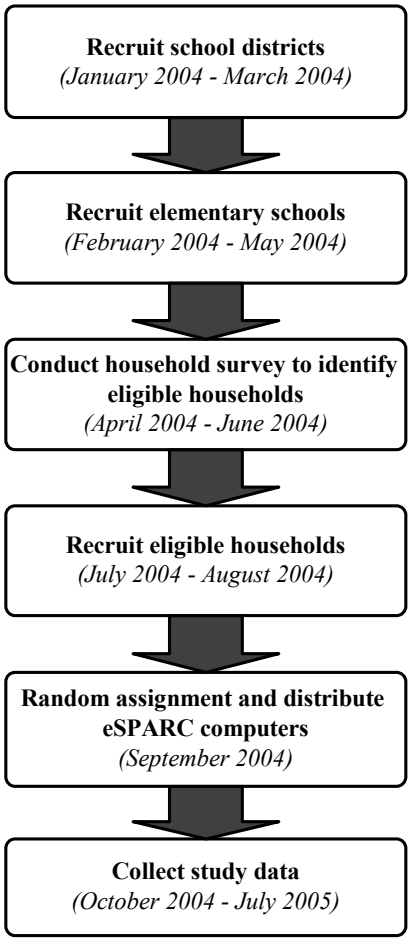
- The September 2005 newsletter described the interactive training CD-ROM on Scholastic Keys that was made available to treatment families and provided tips on how to use the F1 key to pull up a help menu.

Study Methodology

A stated purpose of the federal grant that supported the SPARC study was to increase the capacity of states to "conduct scientifically-based evaluations of educational technology interventions, by planning and conducting an experimental or quasi-experimental evaluation of a state-selected educational technology initiative."[9] In fact, the grant award notice encouraged awardees to conduct their evaluations in a manner that "tests the impact of the intervention as well as the efficacy of the empirical methods, practices, and instruments used to assess the impact of the intervention on student achievement."

In response to this requirement, the study design made use of random assignment to maximize the likelihood that any observed outcomes could be attributed to the SPARC intervention. It also collected a wide range of data that could be used to understand the home and school context within which the SPARC intervention was conducted. As shown in Exhibit 3-8, the study design included multiple steps—including the selection of the study sample, random assignment, data collection, and analysis of study data. The sections that follow provide information about each of these steps, as well as some of the practical issues encountered in the implementation of the study's design.

Exhibit 3-8.—Overview of the work flow for random assignment and data collection



[9] Office of Elementary and Secondary Education—Evaluating State Education Technology Programs Grant Competition—Notice Inviting Applications for New Awards for Fiscal Year 2003 (*Federal Register*, June 11, 2003).

Selecting the Study Sample

Determining an appropriate sample size. In addition to accommodating our random assignment model, the sample size for the study reflected a need to maximize the power of the statistical model used to detect differences between treatment and control group households. In determining the minimum number of schools, we assumed that half of the 5th grade students in each participating school would not have access to a working home computer (and would therefore be eligible to participate in the study).[10] In determining the minimum number of households, we assumed that we would need to over sample in case a significant number of participating 5th grade students moved to other school districts during the 2004–05 school year.

The literature on power analysis (Cohen 1988; Kraemer, Thieman, and Denenberg 1987; Raudenbush and Liu 2000) describes three factors for determining the power coefficient: (1) the desired level of statistical significance (e.g., 1 percent, 5 percent), (2) how the hypothesis was formulated (i.e., one- or two-tailed test), and (3) the critical effect size, which is the magnitude of the difference between the treatment and control group. A sample size of 400 students with a power of 0.80 under a standard 5 percent two-tailed test will be able to detect a statistically significant difference with an effect size of 0.12, assuming the sample was randomly drawn at the individual level (Kraemer, Thieman, and Denenberg 1987), or an effect size of 0.25, assuming the randomization is at the classroom level (Raudenbush 2000). Because within-classroom assignment is a special case and there is no convention to calculate the power for such a design, we use the former as an upper bound estimate and the latter as the lower bound estimate.

Taking these calculations into account, we ultimately set a goal of recruiting 400 5th grade students from 20 elementary schools.[11] While 22 elementary schools were eventually involved in the study, only 354 students participated. This smaller sample size slightly reduced our ability to detect significant differences. The power analysis suggests that the final sample (354 students in 84 classrooms in 22 schools) was adequate to detect statistically significant differences with an effect size of 0.15 as the lower bound estimate and 0.30 as the upper bound estimate, both of which can still be considered small effect sizes by Cohen's standard (1988).

Selecting school districts. To facilitate both data collection and the provision of technology training and technical assistance to study households, we sought to recruit school districts from within a single geographic region. Further, we decided to focus our recruitment efforts on districts that had similar economic and demographic characteristics. Specifically, we concentrated on school districts that (1) were located in midsized urban settings, (2) had high poverty rates (as measured by the percentage of students receiving free or reduced-price lunch), (3) reported low rates of home ownership of computers on the Pennsylvania Technology Inventory (an annual technology survey administered in all Pennsylvania public schools), and (4) had a sufficient number of elementary schools with a grade span of kindergarten through 5th or 6th grade.

Using these criteria, we explored the feasibility of recruiting all of the study schools from the Allentown, Bethlehem, and Easton school districts. Our initial focus on these three contiguous districts reflected several factors—including the similarity of their economic and demographic profiles, their proximity to one another, and their proximity to an organization that had expressed an interest in working with the SPARC program to provide refurbished computers to low-income students. While Allentown

[10] In fact, the proportion of students lacking access to a working home computer was 43 percent.

[11] In a multitrial model, the statistical power of a sample depends largely on the size of the higher level of unit. Therefore, increasing the number of schools in the study enhances the statistical model more significantly than increasing the number of students in each school.

and Bethlehem elected to participate in the study, we were unable to include Easton because its schools did not meet all of the required criteria (i.e., all of its 5th grade students attended a single middle school that only served 5th and 6th graders, as opposed to a traditional elementary school).

In an effort to recruit 20 elementary schools that met our district and school-level criteria (outlined below), we ultimately expanded the study to the Harrisburg, Scranton, and York school districts. However, the elementary schools in Scranton were subsequently removed from the study because they had too few students without home computers to support their inclusion in the study. As a result, the study was conducted in schools from four districts: Allentown, Bethlehem, Harrisburg, and York.

Selecting schools. Although SPARC was designed as an out-of-classroom intervention, we had to collaborate with local elementary schools to conduct random assignment and obtain student-level data. Therefore, once districts agreed to participate in the study, we had to identify a minimum of 20 elementary schools that would be willing to serve as partners and provide the necessary data. To assure some level of comparability across study schools, we developed a series of guidelines that informed our consideration of whether to include or exclude a given school from the study. As shown in Exhibit 3-9, some of these criteria were deemed mandatory—e.g., the principal and all 5th grade teachers had to express an interest in participating in the study and a willingness to provide the required data.[12] In addition, we sought to select schools that shared some common characteristics (most notably high poverty rates, as measured by the percentage of students receiving free or reduced-price lunches).

Exhibit 3-9.—Criteria for school selection

Required Criteria

- Fifth grade in the elementary school.
- High level of interest and support from district and school, as well as written agreement to provide the required data in a timely manner.
- High level of buy-in from teachers—e.g., willingness to provide the required data.
- At least 50 (preferably more) 5th graders in the school.
- Low rate of home ownership of computers.
- Agree to provide Westat with a file that contains contact information for all 4th grade students (to facilitate administration of the Household Recruitment Survey).
- Agree to assign a contact person within the school who will provide assistance with (1) locating households (for the initial phone survey of all 4th grade households), and (2) recruiting households for the study.
- Agree to provide Westat with a file (in Access, Excel, Word, or SAS) that contains the following information on <u>each</u> study participant for grade 5: (1) grades for all major academic subjects, (2) assessment scores in reading and math, and (3) attendance records.
- Agree to provide Westat with a roster of 5th grade classroom assignments for the 2004–05 school year by August 20.

Desired Criteria—*Mobility and Demographics*

- Low student mobility rate (15 percent or lower) *during* the school year.
- Relatively high percentage (70 percent or higher) of students receiving free/reduced-price lunch.

Desired Criteria—*Computer Access and Utilization*

- An adequate supply of computers with Internet access is available for student use in the school library, individual teacher classrooms, or a computer lab.
- Routine computer use by 4th and 5th grade teachers with their students.
- Fifth grade teachers routinely give assignments that require students to use computer technology.
- A website for the school that includes suggested educational Internet links for parents and students.

[12] In fact, several schools that met the economic and demographic criteria eventually elected not to participate because principals were unwilling to burden their teachers with additional responsibilities, and/or the teachers were hesitant to complete a quarterly survey on the academic progress of study participants.

Other criteria, while desirable, were not deemed essential. For example, we initially sought schools with an adequate supply of computers with Internet access. We also attempted to recruit schools in which teachers routinely used computers and the Internet with their 4th and 5th grade students to assure that study participants had the requisite computer skills and ample opportunities to use their SPARC computers for schoolwork. However, the need to select schools that were willing to participate in the study and that satisfied the basic economic and demographic criteria ultimately necessitated the selection of some schools that were not making extensive use of technology in the classroom.[13]

In the end, 22 elementary schools in four districts were selected to participate in the study. It is worth noting that in addition to the seven elementary schools in Scranton, four schools in Harrisburg and two in Bethlehem were removed from the study because survey findings revealed that they had too few students without home computers to support their inclusion.

Identifying eligible households. The final decision regarding the study sample concerned the criteria for selecting the households that would participate in the study. Early on, it was decided that (1) families would only be eligible to participate if they lacked a working home computer, (2) families that had a working home computer but lacked Internet access would not be included in the study, and (3) other criteria (e.g., household income, a student's academic performance, a student's enrollment in a special education program) would not be considered when selecting families for the study. We further decided that families that were eligible to participate would need to agree to some minimum study conditions—i.e., parent attendance at two study events (an orientation session and a 2-hour training session), student attendance at a 6-hour training session, and a willingness on the part of parents and students to participate in all study-related data collection activities. It should therefore be noted that there was a possibility for selection bias, since eligible households could opt out of the study. However, all of the families that were presented with an opportunity to participate in SPARC ultimately enrolled in the study.[14]

Because a family's eligibility for the study was determined solely by whether or not they had a working home computer, it was essential that information about home access to computers be obtained in an accurate and neutral manner. In spring 2004, Westat administered a household survey to the parents of *all* 4th grade students in each of the elementary schools that were scheduled to participate in the study.[15] The purpose was to identify those households that did not have a working computer and were therefore eligible to be recruited for the study. The proportion of students with home access to computers and the Internet was higher than originally projected by local educators. Specifically, 57 percent of respondents had a home computer—and 45 percent of all respondents had home access to the Internet (not shown in tables). The remaining 43 percent reported that they did not have a working computer in their household at the time the survey was administered.[16]

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[13]It should be noted that the need to recruit 20 elementary schools in a relatively short timeframe precluded us from surveying 4th and 5th grade teachers in advance of the study to determine whether they were making extensive use of technology with their students. We did, however, later administer a survey to all of the 5th grade teachers that had students in the study. Findings from this survey, which obtained information about teachers' use of technology in the classroom, suggest that many teachers were not making extensive use of computers and the Internet with their 5th grade students.

[14]The decision by all of the families that were presented with an opportunity to participate in SPARC to enroll in the study likely reflects the fact that control group households ultimately received the same benefits as treatment households—i.e., all control group households received home computers and 2 years of dial-up Internet access at the end of the 2004–05 school year.

[15] Parents with 4th grade students were surveyed in spring of 2004 to identify households without a working computer that would have 5th graders at the time of the intervention.

[16]The survey was administered before parents were aware that their responses would determine their eligibility to receive a home computer and other benefits through SPARC.

Households that did not have a working home computer were invited to attend an orientation session. These sessions, conducted during summer 2004, provided information to parents and their 5th grade children about the benefits of participating in SPARC, the data collection requirements, and the process by which students would be randomly assigned to either the treatment or control group. Parents who were interested in enrolling their students in the SPARC program were asked to sign a consent form.

Of the 504 students deemed eligible for participation in the program, 354 (70 percent) ultimately attended a mandatory orientation session. These were the students that made up the study sample and were randomly assigned to the treatment and control groups. While considerable effort was made to enroll the remaining 149 students, the need to conduct random assignment and provide SPARC computers to treatment group households at the beginning of the 2004–05 school year precluded extension of the recruitment process beyond the first week of school.[17] For almost all of the variables that were examined, the 149 families that were not reached via telephone were not significantly different from the 354 families that attended an orientation session and enrolled in the study. There were, however, three noteworthy exceptions. Specifically:

- Respondents from nonparticipating eligible families were more likely than respondents from participating families to be dissatisfied with the education their child received from their school during the 2003–04 school year (14 percent versus 6 percent, not shown in tables). This finding may explain why some of these families chose not to attend an orientation session (all of which were held at their child's elementary school).

- Other parents (besides the responding parents) in the participating households were more likely than other parents in nonparticipating eligible households not to use computers at all during a typical week (37 percent versus 17 percent).

- Interviews for the Household Recruitment Survey were more likely to have been conducted on a regular telephone line (rather than cell or work phones) within the homes of participating households than nonparticipating households (90 percent versus 83 percent). This finding may explain why we had more difficulty recontacting some of the 149 eligible families that were not included in the study.

Random Assignment

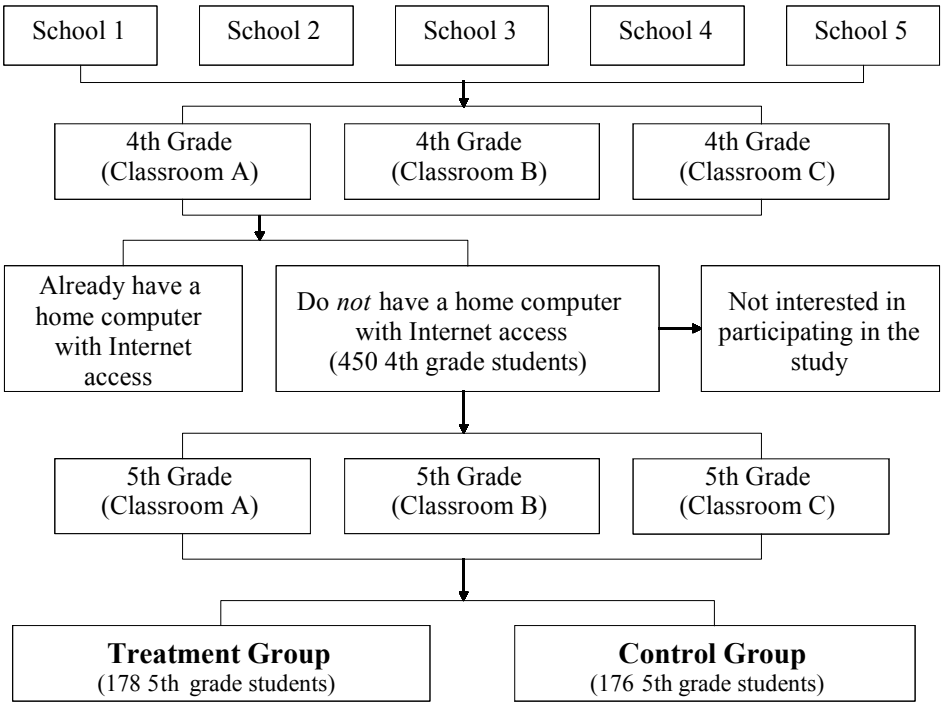
The use of random assignment provided a robust framework for attributing student and parent outcomes to the effects of the SPARC intervention (as opposed to other factors that may influence student achievement or parental involvement). As shown in Exhibit 3-10, the randomized experiment design for SPARC can be characterized as "within-classroom random assignment," with participating 5th graders being randomly assigned to either a treatment or control group within each 5th grade classroom (in each of the 22 schools that participated in the study). Within-classroom random assignment was used to ensure a relatively equal distribution of treatment and control students in each class, thereby allowing us to control for possible confounding variables associated with the instructional practices of individual teachers.

Random assignment was conducted within the 5th grade classrooms of participating schools in September 2004, with 178 students assigned to the treatment group and 176 assigned to the control

[17] In most cases, these 149 families represented households that we were not able to contact via phone or mail in the time that was available to recruit for the study. The vast majority of families that were reached via phone expressed an interest in attending an SPARC orientation session, and all household representatives that attended an SPARC orientation session elected to participate in the study.

group.[18] Students that were randomly assigned to the treatment group received their SPARC computer and dial-up Internet access in October 2004. Control students received similar benefits at the end of the 2004–05 school year.

Exhibit 3-10.—Random assignment design for the study



Based on data from the household survey, we detected no statistically significant differences between the treatment and control groups with respect to household, student, or parent demographic characteristics (see Chapter 5 for a detailed description of the characteristics of study participants). Additional data from baseline parent and student surveys (administered 1 month after the SPARC computers were distributed to treatment group households) demonstrate that the treatment and control groups were also similar with respect to school-related measures. Generally, students from both groups had similar attitudes toward school and computers, had performed equally well on 4th grade report cards, and behaved in similar ways both at school and at home. Parents from the treatment and control groups were equally involved in their children's education and had very similar views about computers. While findings from the fall 2004 parent and student surveys uncovered some differences in terms of computer usage and self-reported computer skills, we attribute these differences to the fact that these surveys were administered after the intervention had begun.[19] As such, treatment students and parents had started to use their home computers, develop their computer skills, and interact with each other around computers. Kleiner et al. (2005) provides a more detailed presentation of findings about initial computer use from the fall 2004 parent and student surveys.

[18]There were originally 177 students in the control group. However, one control student who was found to be living in the same household as a treatment student was ultimately removed from the study sample.

[19]Practical constraints prevented the student survey from being administered before the intervention, mainly because the intervention could not start until the beginning of the school year and it was not feasible to conduct the survey during the summer. We decided then to allow for at least 1 month of computer use for the treatment households in order to get information about computer use early in the intervention.

Data Collection

As shown in Exhibit 3-11, Westat employed a wide range of data collection activities to address each of the study's research questions. These included a household recruitment survey, pre- and post-intervention student and parent surveys, case studies and focus groups, a teacher log and a teacher survey, as well as the collection of grades and PSSA assessment scores from schools and districts. These activities are described below.

Exhibit 3-11.—Crosswalk of study questions and data collection strategies

Research question	Data collection strategies conducted during the 2004–05 school year								
	Parent surveys	Student surveys	Parent focus groups	Student interviews	Computer main-tenance survey	Teacher log	Tracking software[1]	TA log	School data[2]
Did SPARC impact the frequency of computer use?	X	X	X	X			X		
Did SPARC impact the type of computer use?	X	X	X	X			X		
Did SPARC impact computer skills?	X	X	X	X					
Did SPARC impact attitudes and perceptions about computers?	X	X	X	X					
Did SPARC impact students' home life and relationships?	X	X	X						
Did SPARC impact students' interest in academic subjects?	X	X	X	X		X			
Did SPARC impact students' participation in academic subjects?	X	X	X	X		X			
Did SPARC impact students' academic performance?				X		X			X
Did SPARC impact parents' involvement in their children's education?	X	X	X						
Did SPARC impact parents' involvement in their children's personal interests?									
Did SPARC impact the level of communication between parents and teachers?	X		X			X			
What problems did treatment households experience with their refurbished computers?	X	X	X		X			X	

[1] The tracking software was ultimately not used because reliable data were only obtained from a few treatment households.

[2] Includes grades in core subject areas and scores on the statewide assessment in reading and mathematics.

NOTE: This exhibit does not include several data collection strategies that were conducted as part of the study, including the household survey used to identify the households of 4th grade students that would be eligible the following school year to participate in the study, and the teacher survey used to obtain information about the instructional practices of 5th grade teachers who had students in the study.

Household recruitment survey. The household recruitment survey was designed primarily to identify and recruit eligible families for the SPARC program. Administered by telephone between May and September of 2004, this survey was conducted at the beginning of the study to collect information about the household characteristics of *all* 4th grade students in each participating school (approximately

1,700 households), including whether or not the household had a home computer that was in working condition. Households that lacked a home computer were subsequently invited to participate in the study in the following school year. The survey was conducted in both English and Spanish.

As discussed previously, 13 elementary schools were removed from the study because survey findings revealed that they had too few students without home computers to support their inclusion in the study. As such, the data from the household recruitment survey presented in this report only reflect findings for the 22 schools that ultimately participated in the study. Within these 22 schools, the overall response rate for the household recruitment survey was 69 percent (1,180 surveys out of a potential 1,707 households).[20] Of the 1,180 completed surveys, 78 percent of respondents were the mothers of 4th graders, 16 percent were the fathers, 4 percent were grandparents, and 2 percent were aunts or uncles.[21]

The household recruitment survey also provided considerable information about the demographic characteristics of families with 4th graders across the four districts, their computer-related behaviors and skills, and parents' beliefs and attitudes about computers and the education of their 4th graders. The household recruitment survey is presented in Appendix C.

Parent surveys. A parent telephone survey was conducted at the beginning of the SPARC intervention in fall 2004 and again at the end of the intervention in spring 2005. Of the 354 households in the study sample, respondents from 332 households completed the fall survey (a response rate of 94 percent). This survey, conducted in both English and Spanish, included questions on parents' involvement in their 5th graders' education, parents' computer usage and skills, and parents' attitudes and views about computers. Most questions from the fall parent survey were asked of respondents in both the treatment and control groups, but some questions were asked only of the treatment or the control group.[22]

A follow-up telephone survey administered in spring 2005 asked most of the same questions and was used to assess whether the provision of SPARC computers had resulted in significant differences between the treatment and control groups in a wide range of areas. For the spring survey of parents, the response rate was 82 percent, somewhat lower than the response rate for the fall 2004 parent survey. We attribute much of this difference to the mobility of families and the difficulty of locating and contacting families that had moved during the course of the school year.[23] The treatment version of the spring 2005 parent survey is provided in Appendix D.

Student surveys. A student survey was administered in October 2004 by school staff (i.e., teachers, administrators) at the 22 participating elementary schools. Students from the treatment and control groups within each school completed the survey separately in a group setting. Of the 354 students in the study sample, 338 completed the survey (a response rate of 95 percent). The remaining 5 percent either had moved from study schools at the time of the survey or were not available on the days when the survey was administered. The survey included questions on students' use of computers, their computer skills, schoolwork and study habits, engagement in school, interactions with family and friends, and

[20]It should be noted that most of the households that we were able to reach by phone agreed to complete the survey. As a result, the nonresponse rate primarily reflects households that were never reached via phone (after a minimum of seven attempts for each household at different times of day). In addition, we have no way of knowing whether there were any systematic differences between those households that completed the survey and those that did not.

[21]Throughout this report, adult respondents are referred to as "parents," although in a small number of cases respondents were nonparent relatives.

[22]For the treatment group, questions were asked about how the SPARC computers were being used at home, problems encountered, and perceived effects of having the computers. Control group parents were asked whether they had had a computer at home in the past.

[23]It should be noted that while 87 percent of control parents completed the spring survey, a slightly smaller percentage of treatment parents did so (77 percent). This difference in response rates likely reflects a decision to emphasize the collection of surveys from control parents during a two-week period to expedite the date by which home computers could be provided to control households.

attitudes about school, computers, teachers, family, and friends. Treatment group students also received a series of questions pertaining to their SPARC computers. School staff who administered the survey received training and detailed written instructions on how to conduct the survey.

A follow-up student survey was used to assess whether the provision of SPARC computers resulted in significant differences between the treatment and control groups. This survey repeated the same questions posed in the earlier survey. The response rate was 87 percent (85 percent for the treatment students and 89 percent for control students). Unlike the October 2004 survey, which was administered by school staff, the May 2005 survey was administered by Westat staff. The purpose was to ensure standardized interviewing procedures and to allow for follow-up questions that were designed to identify specific survey items that may have been problematic for the 5th grade respondents. As a result of these follow-up questions, two survey items were removed from the final analysis because they appeared to be yielding unreliable responses. The treatment version of the survey is presented in Appendix E.

Focus groups with parents. In January 2005, parents participating in the study in Harrisburg and York were randomly contacted by phone and asked to participate in a focus group being held in their school district. The first 10 parents in each district to agree to participate were included in the meeting. Five of the 10 parents in Harrisburg who agreed to participate attended the focus group, as did 9 of the parents in York. Individuals were paid $40 for their participation. A primary purpose of the two focus group sessions was to obtain immediate feedback for the Pennsylvania Department of Education on the extent to which household members were using the various services offered through the SPARC intervention. A secondary purpose was to identify factors that were hindering study participants' efforts to use their SPARC computers and/or attend the monthly training sessions about basic computer skills.

In July 2006, Westat conducted two additional focus groups with a purposeful sample of treatment parents in York and Allentown. The purpose was to obtain parents' views on how they and their children were using their SPARC computers. Eight parents participated in the York group, and four parents participated in the Allentown group. Individuals were paid $40 for their participation. The criteria used to select these parents were designed to identify treatment households in which (1) at least one study participant (i.e., a parent or the 5th grade student) reported in spring 2005 that he/she was making moderate or frequent use of the SPARC computer, (2) at least one parent was reported to be regularly checking that their 5th grade child was completing his or her homework assignments, and (3) English was the primary language spoken in the home (to facilitate the focus group sessions). As such, it should be noted that the focus group findings in Chapters 4 and 6 reflect the views and experiences of those households that met these three criteria—but not necessarily the views and experiences of *all* households assigned to the treatment group. The protocols used to conduct the January 2005 and July 2006 focus groups are presented in Appendix F.

Student interviews and performance assessment. The purpose of the student case study component was to examine more closely the ability of treatment and control students to make use of computers and the Internet. Interviews and performance assessment were conducted in one of the participating elementary schools in the York School District during the second half of the 2004–05 school year. These data were collected during two separate site visits. The first visit, in February 2005, involved individual interviews with the nine children in the treatment group and nine in the control group who were participating in the study. The interview protocol consisted of a common set of follow-up questions that were asked of all the students, as well as tailored questions based on each student's responses to individual survey items from the fall 2004 student survey. For example, students who reported on the fall 2004 survey that they used a computer for language arts homework were asked to describe the circumstances under which they made use of a computer for that purpose. The intent was to obtain more detailed information about students' responses to specific items, as well as to gain a better understanding of whether students fully understood the meaning behind some of the concepts included on the survey.

During the second visit, conducted in April 2005, we asked students to respond to a series of "research scenarios" that essentially mimicked school assignments. This component presented a hypothetical research assignment and prompted students to talk through (and demonstrate as relevant) how they would go about completing the assignment, including finding research sources. Some of the scenarios were structured in a way that did not *require* students to use computers, but were meant to capture how they might use resources (including computers) given the nature of the assignment. Other scenarios were more direct and asked students to demonstrate Internet-searching techniques and critical word processing skills. In short, the primary purpose of this component was to assess whether students in the study were able to complete a series of computer and Internet-related tasks, and determine if their abilities to complete these tasks differed by study status.

It was not expected that a single school would be representative of the overall study sample. Indeed, a comparison of the characteristics of the overall study sample and the 18 5th graders who participated in the student interview/performance assessment component uncovered some noteworthy differences. For example, household income was lower for the overall study sample than for the case study sample. In addition, 33 percent of study students were African American, compared with 6 percent of case study participants (not shown in tables). Conversely, 24 percent of case study students were White, compared with 11 percent of all study students. There were also differences in the primary language spoken at home, with 78 percent of study students primarily speaking English at home (compared with 59 percent of case study participants).

Findings from the student interviews and performance assessment are provided in call-out boxes throughout Chapter 7. It should be noted that the examples presented in Chapter 7 are not presented as being representative of all students in the study. However, they do present important insights into the skills and opinions of all study participants in one of the study schools. The protocols used to conduct these case study sessions are presented in Appendix G.

Teacher log. Administered at the end of each academic grading period (quarterly), this online form obtained teachers' perspectives on the progress of individual treatment and control group students in their classrooms with respect to various classroom-based academic engagement and achievement measures.[24] The form, designed with input from 5th grade teachers in each of the participating schools, was used to assess behavioral and academic areas not covered on report cards that would potentially be affected by home access to computers and the Internet. For example, teachers were asked to rate the extent to which students in the study worked to the best of their ability on a daily basis, used computers and/or the Internet to locate information, used multiple sources to prepare written assignments and/or projects, and used computers to present information (e.g., to type reports or prepare graphics) over time. The teacher log is provided in Appendix H.

Several issues regarding the teacher log are worth noting. First, teachers only completed the log for those students in their classrooms who were enrolled in the study.[25] As a result, they knew the identity of the students who were participating in the study. Teachers were instructed to disregard any information they had about a student's study status when competing the log. Most of the teachers we interviewed at the end of the study indicated that they did not consider whether a student was assigned to the treatment or control group when responding to specific items.

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[24]Participating teachers were reimbursed for their work on the teacher log and the teacher survey.

[25]Two factors precluded us from obtaining quarterly log data for *all* of a teacher's students. First, parental consent was required for all of the data collected from or about study students. Given that there was no incentive for nonstudy parents to grant access to data about their children, we decided to focus solely on study participants. Second, collecting teacher log information for all students in a classroom would have significantly increased teachers' response burden.

Second, teacher log data were not available for some students for certain quarters of the school year. In some cases, it was because the students had left the school; in others, teachers had not completed the teacher log for a particular quarter. Overall, however, teacher log data were provided for 95 percent of all participating students for the first quarter, 92 percent for the second quarter, 93 percent for the third quarter, and 89 percent for the fourth quarter.

Teacher survey. A survey of 5th grade teachers, administered in the study schools in May 2005, was used to document the extent to which respondents routinely made use of learning technologies in their classrooms. The survey also gathered information on teachers' attitudes toward educational technology, as well as the barriers that they face in integrating technology into their instruction. The purpose was to obtain contextual information that could be used to assess the extent to which study participants were exposed to computers and the Internet at school. The response rate for the teacher survey was 96 percent (the survey was completed by 81 of the 84 teachers). The teacher survey is provided in Appendix I.

Computer maintenance survey. Administered to treatment group parents in July 2005, this telephone survey obtained additional information about the functionality of SPARC computers. Parents were asked whether they were currently having problems with their computers, and if so, what types of problems they were experiencing. Parents were also asked how many times they had called the SPARC technical assistance line and the extent to which the assistance they received was useful. The response rate for the computer maintenance survey was 80 percent. The computer maintenance survey is presented in Appendix J.

Technical assistance log. This online form, completed by technical assistance providers affiliated with the Carbon Lehigh Intermediate Unit, documented the types of questions and issues that were being raised by study participants about their SPARC computers. The log, which could be linked back to individual study households, also recorded information on how a specific issue was resolved. In addition to documenting the computer-related issues and problems that occurred across the study sample, technical assistance providers used the resulting database to monitor the issues that were addressed within and across participating households.

Tracking software. At the outset of the study, a decision was made to use a commercial software program to capture information on the frequency with which individual household members made use of specific computer applications. The software program, which was installed on the SPARC computers before they were distributed to treatment families in September 2004, was designed to use stealth e-mails (whenever a family connected to the Internet) to communicate the following information about each household's computer usage to a secure server at Westat: (1) frequency of computer use, (2) duration of computer use, and (3) type of computer applications used. To avoid issues of privacy, the software program did not collect other information (e.g., Internet URLs, e-mails) that could be captured through the use of this software.[26]

The use of this "spyware" program was intended to corroborate self-reported data from treatment parents and students on the frequency with which they used each of the software programs on their SPARC computers. A secondary purpose was to capture information on additional software programs families chose to install—and the extent to which these additional programs were utilized by household members. However, the software proved to be incompatible with some of the other programs installed on the SPARC computers, and we were unable to modify the programming so as to block the transmission of

[26]It should be noted that as a condition of participating in the study, families provided their consent for having this software installed on their SPARC computer. In addition, we made clear on the consent form that we would *not* use the software program to monitor the websites that household members visited, the e-mails that were sent, or the content of any text that was entered on the SPARC computer.

all URLs. Attempts during summer 2005 to secure the information from individual computers as part of the voluntary servicing of SPARC computers only produced usable data for a small number of machines.[27] As a result, we have not included any of the data collected through this tracking software in this report.

Grades and attendance. Westat collected report card and attendance data for all participating students (for both 4th and 5th grades). Our first level of analysis involved a simple comparison of fourth quarter item-level grades (in the original scales) *within* each of the four participating school districts. However, the analysis of student report cards *across* the four districts required some recalculation to account for a lack of a common reporting format. Specifically:

- There were significant variations in terms of the graded subjects across the four study districts. While all districts provided grades for mathematics, science, and social studies, the number of reading/literature-related subjects ranged from one to five.

- Only two districts reported final subject grades. The other two districts reported quarterly progress grades for benchmarking purposes. For example, in the 5th grade report card, one district had as many as 31 benchmarks for reading.

- The grading scales varied from three to five categories across the four districts. Further, the substantive meaning of grade scales may have been different across the four districts. Thus, even if two districts used the same number of scales, the grades themselves may not have been comparable.

In order to make sense of the idiosyncratic data from report cards, we took the following steps to standardize student grades. First, grades were combined from reading-related subjects (i.e., reading, writing, listening and speaking) to represent reading. Second, fourth quarter progress grades were used to represent final grades if no final grades were reported. Finally, we recoded different grading scales into a three-category scale based on the substantive meaning of different scales: below standard, at standard, above standard.

Statewide assessment scores. Westat also obtained students' scores (scale scores and performance level for the overall, and raw scores for sub-area) on the 5th grade statewide assessment (Pennsylvania System of School Assessments, or PSSA) for both mathematics and reading. (The PSSA is not administered in 4th or 6th grade, so trend data for the statewide assessments were not available.) The purpose was to obtain an independent appraisal of how treatment and control students were performing on a range of commonly administered academic measures. Scores were obtained for all study participants who remained in the state of Pennsylvania and took the PSSA exam during the 2004–05 school year. Overall, scores in mathematics and reading were obtained for 88 percent of all study participants (including 89 percent of treatment students and 88 percent of control students).

As discussed in Chapter 2, many education researchers have expressed concern that such standardized assessments are inadequate measures of the types of learning outcomes (e.g., critical thinking, writing, and problem solving) that are likely to result from technology use. Nonetheless, education researchers have also recognized that these standardized tests will continue to be called upon to assess the impacts of computers on students (although they recommend including such tests as part of a broader array of outcome measures used to assess the overall impact of technology-based initiatives). To

[27] In many instances, it appears that updates to the spyware blocker programs made available to AOL users disrupted the collection of data being collected as part of the study and, in some cases, erased data that would otherwise have been maintained on the SPARC computers.

some extent, the technology-based performance assessment administered to 18 study students in one York school was designed to explore whether treatment students appeared to have enhanced their computer and Internet literacy. The use of this assessment, however, did not preclude the need to examine whether students' access to a home computer influenced their capacity to satisfy broader academic standards.

Data Analyses

Four separate methods were used to examine the impact of the SPARC intervention on students and parents: (1) analysis of differences in average outcomes on individual measures (e.g., specific survey items, grades for specific core subjects, scores on assessments for mathematics and reading) between treatment and control group participants, (2) analysis of differences in average outcomes on factor scores (e.g., multiple survey items that pertain to a broader outcome) between treatment and control group participants, (3) multivariate analyses that allowed for a more comprehensive analysis of the impact of the SPARC intervention on key outcomes while controlling for other variables, and (4) analysis of qualitative data from the focus groups and case studies. Each of these methods is described below, while Appendix A provides more detailed information about how these methods were developed and applied to the study questions.

Bivariate analysis of student and parent outcomes. Chapters 7 and 8 examine the bivariate differences between treatment and control participants on a wide range of survey and administrative (e.g., report cards, assessment scores) items. The purpose is to ascertain whether there were any statistically significant differences between household members who did (treatment) and did not (control) receive an SPARC computer and Internet access during the 2004–05 school year. In comparing the differences between the treatment and control groups, tests of statistical significance were conducted, including *t*-tests and chi-square tests. Comparisons in the report were tested for statistical significance at the 0.05 level ($p \leq .05$). Comparisons on items that were statistically significant at the 0.05 level suggest a 95 percent probability that a program impact actually occurred, i.e., that treatment participants were affected by the intervention. Only statistically significant differences are called out in the text.

For both the student and parent surveys, multiple questions were developed around key concepts such as student engagement in school, student computer skills, and parental involvement. While the descriptive statistics at the individual item level from these questions were informative, it was difficult to examine them simultaneously in the statistical model (described below). It was also difficult to look across individual survey items (e.g., ability to use computers for such discrete tasks as word processing, spreadsheets, locate information on the Internet) to state conclusively whether the intervention had a significant impact on a broad indicator (e.g., overall computer skills). Factor analysis was therefore used to statistically determine whether individual items that appeared to be related to one another (from a theoretical perspective) actually belonged to the constructs we had in mind. The responses from the items under the same construct were then used to build composite scores by taking into account the factor loading of the item to the construct. Appendix A provides a more detailed description of the process used to develop these factors, as well as the individual items that were considered and eventually included in the factors that appear in this report.

In addition to verifying the relationship between individual survey items under larger constructs (e.g., student engagement, parental involvement), the factors allowed us to make bivariate comparisons between the treatment and control groups to detect evidence of impact for these broader indicators. Chapters 7 and 8 include such comparisons (using *t*-tests and effect sizes) to determine whether the intervention had a significant impact on treatment students and parents in several key areas. Factor scores were also used in the multivariate analyses that are described below.

While the sample size of 354 households was sufficient to detect statistically significant impacts for all study participants, it did not allow for bivariate analyses of impacts for individual subgroups with an adequate statistical power. Such analyses would have been used, for example, to assess whether the magnitude of an impact (e.g., frequency of computer use) was larger or smaller for specific demographic variables (e.g., gender, race/ethnicity), household characteristics (household composition, educational attainment of parents, employment status of parents, household income, primary language spoken at home), or student participation in educational programs (e.g., honors, special education). However, as is discussed below, a series of multivariate analyses were used to assess whether the impact of the SPARC intervention was different for specific subgroups of study participants.

Multivariate analysis. In addition to study status (that is, assignment to the treatment or control group), other factors (e.g., student characteristics, teachers' use of learning technologies in the classroom) have the potential to influence such student outcomes as frequency of computer use and academic achievement. External factors (e.g., educational attainment, employment history, marital status) can also affect such parent outcomes as involvement in their child's schoolwork and hobbies. While random assignment allows for a systematic and unbiased bivariate comparison of outcomes across treatment and control participants, the use of more sophisticated statistical procedures provides further advantages. Specifically, by including these other factors in a statistical model that "explained" student and parent outcomes as the joint result of exposure to the SPARC intervention and other preexisting conditions, we can further increase the level of confidence about the process used to generate impact findings. We can also examine whether the impact of the SPARC intervention was different for specific subgroups of students and parents.

Therefore, in addition to the bivariate analyses described above, we used a combination of multivariate techniques, including hierarchical linear modeling (HLM), to (1) control for a variety of other factors to assess whether observed differences between the treatment and control groups could actually be attributed to the SPARC intervention, and (2) examine whether there were specific characteristics (e.g., gender, race/ethnicity) or preexisting conditions (e.g., household income, primary language spoken at home, parental involvement) that reinforced or diminished the impact of the SPARC intervention. The use of multivariate models to examine whether there were any differentiated impacts for specific subgroups is particularly relevant, given the study's objective of providing policymakers with an understanding of the conditions under which adapting the SPARC intervention would be most likely to produce positive impacts on students and parents.

Chapters 7 and 8 present findings from the multivariate analyses, while Appendix A provides a description of process used to conduct the multivariate analyses. It should be noted that only multivariate results that are relevant to the study's primary research questions are presented in this report.

Most of the variables included in the multivariate analyses relied on preexisting conditions that were measured before the SPARC intervention. However, it should be noted that we ran a number of HLM models that included endogenous variables, that is, variables that could conceivably be influenced by the intervention itself.[28] While some consider this to be a controversial approach, we include these results in Chapter 7 to allow for analysis of a limited number of factors that would otherwise not be possible.

Analysis of qualitative data. Content analysis was used to analyze the data obtained through the focus groups and case studies. Interview data were initially coded according to the categories in the

[28]Under optimal conditions, data on these variables (e.g., student engagement, parental involvement) would have been collected prior to the SPARC intervention. However, the need to distribute the SPARC computers to treatment households as soon after random assignment as possible precluded us from obtaining these baseline data.

interview protocols. Descriptive codes were then used to classify data into specific themes. After multiple reviews, descriptive codes were replaced by pattern codes, which enabled us to identify emergent patterns in the qualitative data. Validity was addressed primarily through a search for disconfirming evidence. When the data contradicted emergent patterns, operative understandings were reframed; however, if the number of discrepant, "outlier," or exceptional cases was higher than the number of supporting cases, corresponding emergent patterns were viewed as not valid and subsequently dropped. Credible patterns were reflected in the findings and supported by repeated occurrences and ample illustrations.

Summary

The SPARC intervention provided treatment households with access to a refurbished Dell Pentium II/III computer, dial-up Internet access, speakers and a printer, office and educational software programs. Supplemental services included introductory training, monthly follow-up training on a range of technical skills, technical assistance with computer and Internet problems, a monthly newsletter, and access to a program website that included links to other useful websites for students and parents. The study design that was put in place to evaluate the impact of SPARC relied on a lengthy recruitment process that was specifically designed to identify elementary schools serving predominately low-income households and students who did not have access to a working home computer. The strength of the study design was enhanced by the use of random assignment within study students' 5th grade classrooms, which enabled us to examine the impact of SPARC between treatment and control group participants.

4. FACTORS AFFECTING THE IMPLEMENTATION OF THE SPARC INTERVENTION AND STUDY DESIGN

The development of the original SPARC proposal was guided by a review of existing literature regarding best practices, as well as a series of informed assumptions regarding the conduct of the intervention and study design. However, as with any intervention or evaluation, the actual SPARC study involved some compromises and key decisions that were influenced by prevailing circumstances. In considering the scope and implementation of the SPARC intervention, several key decisions made at the outset of the study are worth noting. First, the decision to provide the full range of study benefits to control group households at the end of the 2004–05 school year reflected ethical concerns about withholding benefits from control group students, as well as a need to offer control group families a significant incentive to provide data throughout the course of the study. Second, the decision to limit the length of the SPARC intervention to the 2004–05 school year was a consequence of the 36-month timeframe imposed by the federal grant, the difficulty of maintaining the study status designation over two school years (especially with study students transitioning to middle school), and the desire to provide control group households with a home computer prior to the beginning of the 2005–06 school year.[29] Third, the decision to focus on 5th grade students reflected the availability of state assessment scores in two core subjects as a measure of student achievement,[30] as well as the ease of within-classroom random assignment and data collection (since students only had a single teacher). Finally, the imposed timeframe also informed the decision to complete all tasks associated with the selection of the study sample and the distribution of refurbished computers in a 9-month period.[31] However, the desire to distribute computers to treatment students as early in the 2004–05 school year as possible ultimately limited the capacity of SPARC intervention staff to proactively plan for the multiple tasks that needed to be handled in the first 9 months of the study.

At the outset of the study, members of the U.S. Department of Education's advisory panel expressed an interest in having us document the accuracy of the original assumptions guiding the SPARC intervention—including the reliance on refurbished computers, the quality of and attendance at voluntary technology training sessions, and the project's capacity to provide timely technical assistance. They also expressed an interest in whether the study design would encounter such problems as contamination in control group households, high rates of student mobility, and an inability to collect data from study participants. As such, an important component of the study was to provide policymakers, practitioners, and researchers with an accurate assessment of whether the original assumptions regarding the intervention and study design were realistic and feasible.

Within this context, this chapter begins by describing a range of factors that ultimately affected the scope and conduct of the intervention. It then provides findings regarding the range of technical difficulties that treatment households encountered with their refurbished SPARC computers. The chapter concludes with a discussion of the challenges encountered in implementing various aspects of the study design.

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[29] One concern was that control groups would not be willing to wait more than 9 months to receive their home computers. A second concern was that after the end of the 2004–05 school year, it would become increasingly difficult to locate control students.

[30] At the time of the study, the statewide assessment was administered only in grades 3, 5, and 8.

[31] Because the intervention was limited to a single school year, an overriding objective was to distribute computers as soon as 5th grade classroom rosters had been finalized (so that we could conduct random assignment). Since work on the project began in January 2004, SPARC staff were left with the option of waiting another year to develop all aspects of the intervention or focusing all of their energies on distributing home computers to treatment students as early in the 2004–05 school year as possible.

Factors That Affected the Intervention

While all of the benefits described in the original proposal to the U.S. Department of Education were made available to participating families, a combination of factors (many beyond the control of SPARC intervention staff) inevitably moderated the scope and/or quality of the services made available to treatment participants. The following description is designed to document factors that affected the scope of the SPARC intervention, as well as to provide other states with examples of conditions that commonly influence the conduct of technology initiatives that are the subject of rigorous evaluation studies.

Inability to Test a Community Service Model for Providing Donated Computers and Technical Assistance

The SPARC intervention deviated from the original model in one critical area. As described in the Pennsylvania Department of Education (PDE) proposal to the U.S. Department of Education, the intervention was viewed as an opportunity to assess the use of local resources to conduct such activities as computer refurbishing and distribution, training, and technical assistance. The purpose was to develop a service delivery model that might be replicated by other low-income communities with access to similar community-based agencies that were looking to donate and/or refurbish used computers:

> Much of the time and resources provided by participating recycled computer organizations will be donated. Many staff members work on a volunteer basis, providing project support, technical assistance, and training. They will also be responsible for securing equipment and software donations and locating facilities for training and work purposes. The contributions made by participating recycled computer organizations are significant and integral to the success of this type of technology intervention, particularly in economically disadvantaged areas. We are fortunate to have established computer-recycling organizations that are able to provide considerable resources interested in participating in this program.
>
> The Pennsylvania Department of Education Office of Educational Technology has provided recommendations on the design of the SPARC project, and will continue to provide counsel and technical assistance during its implementation. However, PDE has chosen to support SPARC mainly through partnerships with organizations that provide existing mechanisms best suited to implement the technology intervention in an effort to (1) encourage flexibility and local control; (2) support existing efforts to bridge the digital divide, increase parental involvement, and student achievement; and (3) promote projects that utilize existing resources and are replicable in economically disadvantaged and rural communities.

As such, the process of distributing computers was to be handled by a community agency that had considerable experience refurbishing and donating PCs to local families. However, demands made by the community agency after the SPARC grant was awarded forced staff from the Pennsylvania Department of Education and the Carbon Lehigh Intermediate Unit to assume responsibility for securing and refurbishing the computers. In light of the need to identify alternative options for securing donated computers in as timely a manner as possible (given the study's abbreviated timeframe and the need to acquire 200 refurbished computers by the beginning of the 2004–05 school year), the program was fortunate to obtain donated computers directly through a national corporation (as opposed to a local computer-recycling organization). And while the partnership with the Dell TechKnow Program granted

the SPARC program access to a considerable number of donated computers, the reliance on a national corporation precluded the study from assessing the feasibility of having a community-based organization assume full responsibility for providing technical assistance and addressing computer-related problems.

Inability to Conduct the Study in Contiguous School Districts

Under the original approach, the schools and districts that participated in the study were to be located in a single geographic region. The purpose was to realize economies of scale in the servicing of inoperative computers and in the provision of ongoing training to treatment households. However, only two of the four districts (Allentown and Bethlehem) that ultimately participated in the study were contiguous (see the discussion in Chapter 3 about district recruitment). The remaining two districts (Harrisburg and York) were located within 20 miles of each other but were approximately 100 miles from Allentown and Bethlehem.

There is anecdotal evidence that this distance between at least some of the study sites hindered the program's capacity to provide treatment households with timely technical assistance. Specifically, several of the treatment parents who participated in the focus groups described having to wait weeks (or longer) to receive technical assistance for their computers (see the discussion in Chapter 6). This occurred, in part, because the SPARC program director often had to wait until there were enough problems in a specific school district to warrant the lengthy drive required to conduct home visits. Had the study been conducted in contiguous school districts, it is likely that this problem would have been less severe.[32]

Abbreviated Timeframe for Planning the Intervention

The Pennsylvania Department of Education was notified by the U.S. Department of Education that its SPARC proposal had been approved in October 2003. However, due to a combination of factors—most notably a need to address concerns raised by the U.S. Department of Education's advisory panel and await formal approval from the Pennsylvania State Legislature for the inclusion of the federal funds in the state budget—work on developing the intervention was delayed until January 2004. The need to distribute computers to treatment students as early as possible ultimately limited the capacity of SPARC staff to proactively plan ahead for the multiple tasks that needed to be handled in a 9-month timeframe—including recruiting school districts and then schools within those districts, acquiring and refurbishing approximately 200 donated computers, developing training topics and materials for both the mandatory computer rollout sessions and the voluntary technology skills seminars, contacting each of the 22 study schools to arrange space and recruit school-based teachers for the training sessions, providing technical assistance to treatment households that were experiencing technical problems with their SPARC computers, and setting up an SPARC website.

Problems associated with the abbreviated timeframe were exacerbated by the lack of an SPARC program director for the first 6 months of the project. Although the project began recruitment for a program director as soon as the grant was awarded, an acceptable candidate was not identified and hired until July 2004. The search for a director was hindered by the need to identify a candidate who had the requisite technical skills, as well as at least some classroom experience and fluency in both English and Spanish (Spanish was a primary language for many study participants).

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[32] As is discussed in Chapter 9, this problem might have also been alleviated if technical assistance staff had been situated in each of the four districts. However, the original proposal did not consider the possibility that two or more geographic regions would participate in the study, nor did it anticipate a need to conduct so many home visits to deal with malfunctioning computers. As such, the project budget did not include funding for having technical staff in multiple sites.

The delay in hiring an SPARC project director who could devote his full time to the intervention served to limit the initiative's capacity to plan ahead with respect to several key start-up activities (e.g., devising an effective refurbishing process, developing training materials and identifying site-based trainers, establishing technical assistance procedures). This, in turn, made it difficult to launch multiple outreach and training activities immediately following the distribution of home computers to treatment households (in early October 2004). As such, the optional technology skills training for treatment households did not begin until mid-November, approximately 5 weeks after the computers were distributed to treatment households. In addition, these evening sessions were initially offered in only one school per district, thereby allowing the SPARC program director to conduct each of the trainings. Attendance at these initial sessions was quite low—only 14 treatment families attended the November 2004 session, and two treatment families attended the January 2005 session (see Table 6-7 in Chapter 6).

There is no way of knowing whether attendance at the initial training session would have been higher if it had been offered 1–2 weeks after computer rollout (e.g., to build on the momentum of the initial excitement families experienced when they first received their SPARC computer). Nor is it clear whether attendance would have been higher if the sessions had been offered at each participating school in the district (as opposed to one school per district), or if school personnel had been asked to take on a greater role in publicizing and promoting the training. However, as is discussed in Chapter 9, all of these approaches would have required more lead time and/or additional personnel within the Carbon Lehigh Intermediate Unit (or another entity) that were primarily focused on developing and implementing a coordinated set of technology training modules and identifying a cadre of local trainers.

Problems With the Refurbished Computers Provided to Treatment Households

There are several potential benefits of using refurbished personal computers to address the digital divide, most notably the ease and low cost of obtaining used computers as companies upgrade to newer models.[33] However, there are also several potential drawbacks to relying on refurbished computers, including the poor quality and unreliability of some older models, the time and expense required to upgrade used computers so that they can make use of current software programs, the high rate of failure for specific components (e.g., hard drive, power supply) of some brands of refurbished computers, and the need to provide ongoing technical assistance to users who do not know how to make even simple repairs when their refurbished PCs fail to operate. A study by Open Research (2004) that examined the pros and cons of using new or refurbished computers to supply businesses and schools with affordable technology solutions concluded that refurbished machines are a mixed blessing:

> Yet refurbished PCs are controversial. Their success rate is balanced by an equal force of negative experiences…Problems include a lack of standardization and mixed quality (which SchoolNet Namibia calls "trick or treat donations"), incompatibility with technologies already in use, frequent breakdowns and a lack of skills and technical know-how needed to repair them. These experiences result in statements like: "If an organization doesn't have a big budget, don't give them refurbished PCs!"

[33]Many terms are commonly used to describe used computers that are donated to a third party (e.g., donated, used, recycled, and refurbished). The PCs provided to study participants were refurbished—that is, they had undergone some form of testing, troubleshooting, cleaning, repair, and/or maintenance. Therefore, for the purposes of this discussion, we are examining the feasibility and implications of using refurbished computers to address the digital divide.

A Westat study (Barfai et al. 1999) found that a Maryland initiative that provided 29 low-income middle school students with refurbished computers and dial-up Internet access encountered a number of technical challenges:

> The project was designed to test the feasibility of using donated computers to link low-income families with the information infrastructure. From the outset, however, BCPS [Baltimore County Public Schools] experienced considerable technical difficulties associated with its reliance on used equipment. All of the refurbished computers that were initially installed in the homes required considerable repairs…By the time of the site visit, extensive repairs had been made to all of the donated computers. In some cases, the original equipment had to be entirely replaced. In others, the donated computers required the installation of an entirely new or refurbished hard drive…Several of the families added their own software (e.g., games) to their computers. While this was not against BCPS policy (there had been no policy), the supplemental software slowed the operations of the donated equipment and led to other related malfunctions.

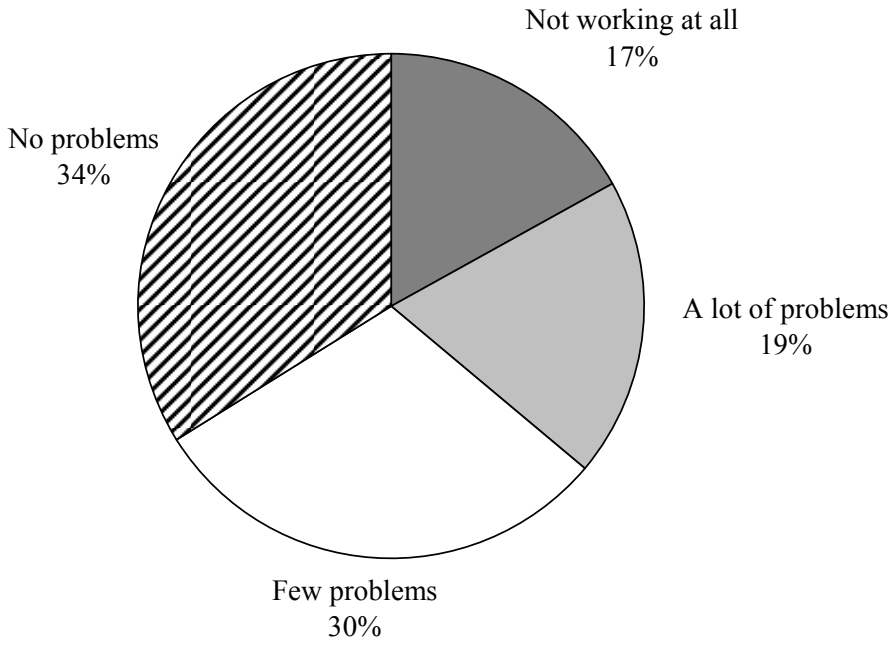
In light of the potential benefits and drawbacks of relying on refurbished computers, the study collected information from treatment households about the functionality of their SPARC computers and dial-up Internet connections. The purpose was to obtain contextual data that could be used to assess whether any technological obstacles limited students' and parents' use of their SPARC computers. These data, summarized below, are evidence that the refurbished computers provided to treatment households exhibited many of the same problems encountered by participants in the Maryland initiative.

Ten months after they took possession of their SPARC computers, 64 percent of treatment parents reported that their computers had few or no problems (Figure 4-1).[34] The remaining treatment parents reported that their SPARC computer had either a lot of problems (19 percent) or was not working at all (17 percent). Among those parents who reported having experienced a problem with their SPARC computer during the previous 10 months, 46 percent indicated that their computer had been too slow *at one point in time*, with 35 percent indicating that this was still an issue at the time the survey was administered (July 2005) (Table 4-1). Many treatment parents also reported being unable to connect to the Internet (41 percent) or experiencing trouble with their AOL account (40 percent).[35] It is worth noting that only a few treatment parents reported experiencing problems with slow Internet connections (14 percent), computers that would not start (14 percent), printers (12 percent), specific software programs (12 percent), the monitor (8 percent), and the mouse (7 percent) that were supplied with the computer.

[34] We have no way of knowing whether the individuals who reported that their computers were in good working condition had ever had their SPARC computers repaired or swapped out. However, 76 percent of the 41 households that reported no problems in summer 2005 also indicated that they had never had any problems with their SPARC computer.

[35] As discussed in Chapter 3, confusion by some treatment households over usernames and passwords resulted in billing problems for approximately 25–30 percent of treatment families. This may have contributed to the number of respondents who reported problems with their Internet service.

Figure 4-1.—Percentage of treatment parents who reported that they were having problems with their SPARC computers in summer 2005



SOURCE: eSPARC Computer Maintenance Survey, summer 2005.

Table 4-1.—Type of problems treatment parents reported with their SPARC computers and dial-up Internet connections

Problem	Ever occurred	Still occurring
Computer too slow	46%	35%
Internet will not connect	42	30
Trouble with AOL account	40	29
Computer freezes	25	16
Internet interruptions/sudden disconnects	15	7
Internet connection too slow	14	8
Computer will not start	14	6
Printer jams/will not work	12	9
Specific computer program will not work	12	5
Monitor does not work	8	6
Mouse freezes/will not work	7	2

NOTE: This question was only asked of the 66 percent of treatment households that reported that they had *ever* experienced a problem with their SPARC computer. As a result, these percentages pertain to those treatment households that ever had a problem with their SPARC computer, not to all treatment households.

SOURCE: eSPARC Computer Maintenance Survey, summer 2005.

January 2005 Parent Focus Groups:
Initial Problems with the SPARC Computers and Internet Connections

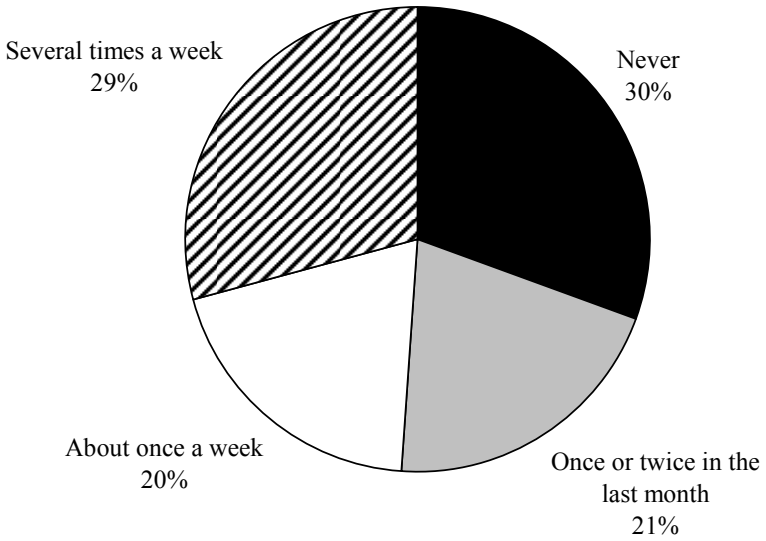
During the January 2005 focus group, a small sample of treatment parents from Harrisburg and York was asked to describe the types of problems they had encountered with their SPARC computers. The following responses were provided by four different participants in one session:

> *We can't get the Internet on our computer. This started happening 3 weeks after she [daughter] got the computer. There is a flashing blue light on the bottom right of the computer screen, and one error message that comes up. My wife has left a message on the eSPARC hotline. I've called more than once; the same screen keeps popping up, but we just X it out. One key isn't working when my daughter plays pinball. She doesn't have problems with it in other applications. One time they reached someone [not clear if eSPARC helpline or AOL tech support] and the problem was fixed for one day, but now it doesn't work again. They use the computer for games now only.*
>
> *We had one problem, tried the eSPARC number, but couldn't get through. Then a phone number popped up on the screen when she tried to log on so she talked to someone [AOL tech support] and fixed the problem. Everything is fine now.*
>
> *The speakers aren't working. She [wife] didn't call the hotline because she had bought the speakers herself. Then our daughter got a new pair from school and they don't work either. She [daughter] can't get on the Internet either. I called the hotline for her and couldn't get anyone.*
>
> *We can't get on the Internet for about a month now. We get to the second step and then it doesn't work; it tells us to renew the license. I've called twice and left messages on the hotline. I never got the AOL assistance number to pop up like [another parent] did.*

In another session, three parents said that they had trouble with their computers crashing. Another parent said she had a problem with computer viruses, which elicited agreement from the other parents. Family members were able to resolve the computer problems for two of the parents. One parent said that the SPARC program gave her a different computer, and another parent said that option is being discussed in her case as well.

Treatment students provided a similar assessment of how well their SPARC computers worked. Approximately half (49 percent) reported in May 2005 (8 months after receiving their SPARC computers) that they had experienced a problem with their SPARC computer at least once in the past week, while 30 percent reported that they had never experienced a problem (Figure 4-2). However, it is worth noting that the treatment students who made greater use of their SPARC computers were more likely to report functional problems.[36]

Figure 4-2.—Frequency with which treatment students experienced problems with their SPARC computer within the previous month

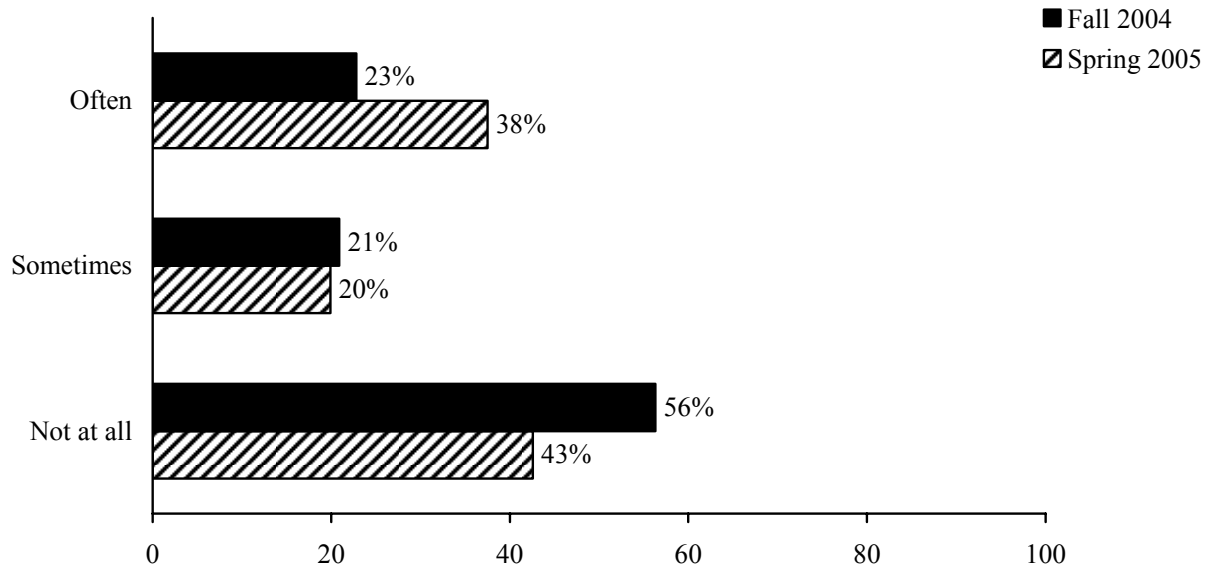


SOURCE: eSPARC May 2005 Post-Intervention Student Survey.

There is some evidence that the SPARC computers became less functional over the course of the 2004–05 school year. Over one-third (38 percent) of treatment parents reported experiencing frequent problems with their SPARC computer or Internet service in spring 2005, compared to 23 percent in fall 2004 (Figure 4-3). Conversely, the proportion reporting no problems with their SPARC computer decreased from 56 percent to 43 percent. The percentage of treatment parents reporting any problems with their SPARC computer, Internet connection, or printer also increased over the same period (Figure 4-4). For example, the proportion of parents reporting that their SPARC computer "wouldn't work well or not at all" increased from 38 percent in fall 2004 to 59 percent in spring 2005. And because the parent surveys did not capture information on whether a given household's computer had been repaired or swapped out, the number of SPARC computers that had experienced serious problems that required repair or replacement was likely higher over the period that we examined.

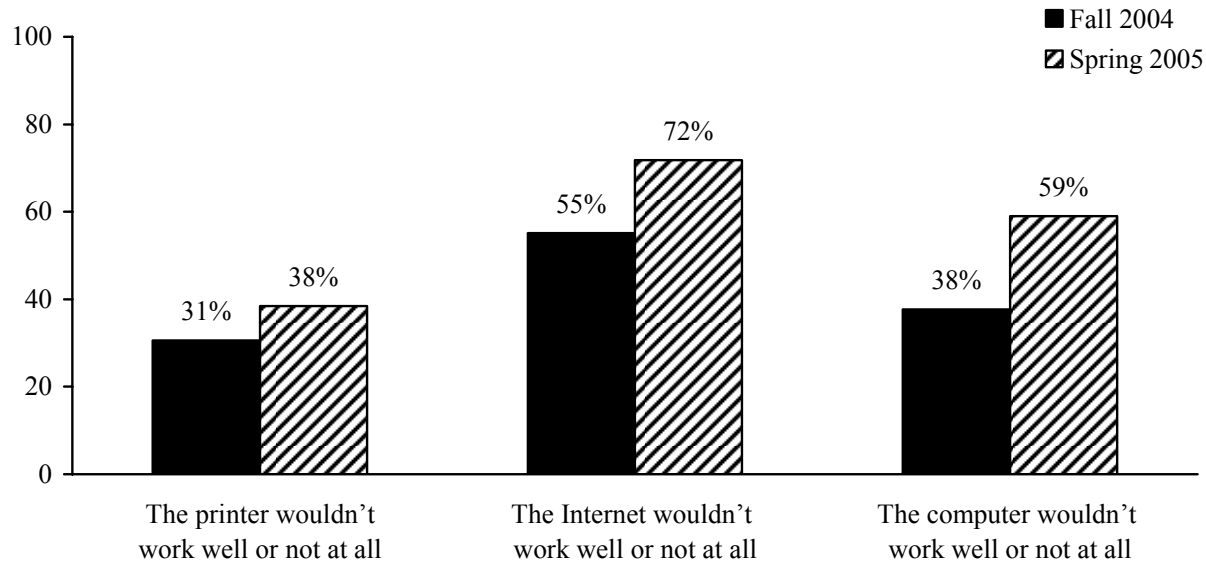
[36]Specifically, statistical tests showed a strong correlation between frequency of SPARC computer use among treatment students and the extent to which treatment students reported problems with their SPARC computers.

Figure 4-3.—Frequency with which treatment parents experienced problems with their SPARC computer and Internet connection within the previous month



NOTE: Percents may not sum to 100 because of rounding.
SOURCE: eSPARC fall 2004 Parent Survey and spring 2005 Post-Intervention Parent Survey.

Figure 4-4.—Types of technical problems reported by treatment parents



SOURCE: eSPARC fall 2004 Parent Survey and spring 2005 Post-Intervention Parent Survey.

These findings suggest that the refurbished computers distributed to treatment households were adversely affected by a range of technical problems. There are several potential explanations for these problems. For example:

- Some of the donated CPUs may have had technical problems that went undetected during the refurbishing process. In fact, the Carbon Lehigh Intermediate Unit devoted considerable effort to replacing nonfunctioning modems in the month following the initial distribution of SPARC computers. In addition, several of the SPARC PCs that we reviewed as part of the August 2005 tune-up had specific problems (e.g., loose case, nonfunctional CD-ROM or floppy disk drives). However, we have no way of knowing whether these problems were present when the computers were distributed to treatment households or were the result of mishandling by the families themselves.

- Interviews with staff from the Carbon Lehigh Intermediate Unit suggest that an underlying cause for these technical problems was the lack of time in the schedule for examining and refurbishing 200 computers. Specifically, more time was needed to (1) develop a more robust refurbishing process, (2) identify poor-quality PCs that should not have been passed on to treatment households, (3) detect hardware and software problems that could be fixed before passing computers on to treatment households, and (4) install America Online accounts instead of having families establish their own accounts, which ultimately resulted in billing problems for some treatment households.[37]

- Some of the technical and functional problems may have been the result of actions taken by treatment households themselves. For example, there is evidence that the additional software that some treatment households added to their machines ultimately contributed to the range of technical problems they reported. It is therefore not surprising, given the limited processing speed and memory of the CPUs that were distributed as part of the study, that families that overloaded their computers with new software (or inadvertently accepted spyware and other software programs from the Internet) ultimately expressed dissatisfaction with the processing speed of their CPUs.

[37]The process used to reconfigure the donated computers was further complicated by the need to devise separate refurbishing procedures for the different computer models that were distributed to treatment households (see Chapter 3). This requirement, coupled with the abbreviated timeframe that the Carbon Lehigh Intermediate Unit had to reconfigure the treatment computers, may have caused staff to inadvertently overlook some existing problems with the donated computers during the refurbishing process. It is also worth noting that problems with the process used to set up computers and Internet accounts for the treatment group ultimately informed decisions about how to improve the process for setting up computers and Internet connections for the control group. Specifically, the same computer models were acquired for all control group households, and the new operating system and software were "ghosted" (as opposed to being manually installed on each PC). According to a consultant for the Carbon Lehigh Intermediate Unit who was responsible for responding to technical assistance requests from study participants, a considerable number of the control group computers ultimately had to be replaced because they would not boot. However, the study did not collect data that could be used to assess the quality of the computers provided to the control group—or the extent to which control group households reported longer term problems with computer functionality and reliability.

Summer 2006 Parent Focus Groups: *Computer Functionality*

Parents were asked how the SPARC program might be improved if similar efforts were initiated in the future. The main suggestion was to distribute better computers, since parents felt that the existing refurbished machines were "too slow" or "freezing all the time." For example:

> (Parent 1) *It would freeze just about all of the time, it would freeze you know and then you would reset it and reboot the whole thing and then it would run fine for maybe an hour maybe two hours and then it would freeze. You know, I got used to dealing with that but then when it just died, it just died. I could get nothing. It says your modem could not be connected to the phone line. We tried everything, I hooked up different phones to that line. I got a scan thing for a shopping survey that every time you buy something you scan it. That's plugged into that, so that works, so it's not the phone jack, it's actually the computer itself.*

> (Parent 2) *I think they should start off with new computers because my compute—the one that I got—always was freezing. And if you put a game on it, the game would move like seconds, it would be all slow motion, the AOL, it was up, the kids had fun and then something happened with AOL and then AOL never was put back on….It got to the point where I just unplugged it, we didn't even deal with it any more. And then someone came out and gave them a new computer as well, another computer and that one worked, but now something doesn't work on it— it's just always something is wrong, so all they do is play games on there and she types her reports, but that's it.*

Another parent blamed the quality of the computer for her son's lost assignment:

> *Well, I think that it is a good lesson from this program that if you're going to do something like this and give kids home computers, they should be of good quality. Don't build them up and all of a sudden…. like now, my son was actually mad because his science project was on our computer. And he lost it. He lost it because the file for some reason now cannot be found. They're [SPARC technical assistance staff] saying there was no file even though we know there was, because we know which file is on when you look at the screen, you can find the file but when you go and click on it, it's not there."*

Challenges Encountered With the Study Design

The decision to use random assignment to assess the impact of an out-of-classroom intervention allowed us to circumvent some of the challenges that are commonly experienced by school-based random assignment studies. Most notably, concerns about contamination were mitigated by the fact that we were focusing on the impact of having *home access* to computers and the Internet (as opposed to the impact of in-school access or overall computer *use*). Thus, even though control group students could make use of a computer at various out-of-school locations (e.g., a public library, a relative's home, or a friend's home), they could not replicate the ease of home access unless their parents purchased a computer.[38]

We did, however, encounter a number of practical challenges with respect to the recruitment of the study sample. As discussed previously, these challenges included (1) an inability to recruit contiguous

[38]In fact, a small percentage of control group households (about 23 percent) did come into possession of a home computer during the intervention phase, according to survey findings. Excluding these households from the comparison of treatment and control students and parents did not affect any of the study findings.

school districts for the study (which ultimately complicated the intervention and increased the cost of data collection), (2) the decision by some schools that met the desired criteria not to participate in the study (e.g., because of concerns about the data collection burden), (3) the inability to employ teachers' in-class use of technology as a criteria for selecting study schools (which prevented us from conducting the study in classrooms that were making frequent use of learning technologies), and (4) the need to exclude districts and schools that agreed to participate but lacked a sufficient number of students who did not have home access to a working computer.

While some of these challenges were unavoidable, others occurred as a result of the 9-month timeframe in which we had to simultaneously develop data collection instruments and recruit the study sample. For example, some principals were hesitant to participate until they had an opportunity to review the teacher surveys to assure that teacher response burden would be minimal. Had there been more time at the front end of the schedule, we might have been able to develop these surveys in time to share them with schools when we asked them to participate in the study. It is worth noting that one challenge we expected—parents' reluctance to participate in the study—never materialized.[39]

One of the major threats to the validity of experimental studies is the potential for high rates of attrition of study participants over time. However, the study's 5.6 percent attrition rate was actually much lower than expected. Of the 20 students who did not complete a post-intervention survey, nine were from the treatment group and 11 were from the control group. A comparison of pre-intervention data found almost no differences in the characteristics of students who did and did not complete the post-intervention survey. The one notable exception was that students who did not complete a post-intervention survey were more likely than those who did to report spending a greater amount of time on computers.

Several other analytic challenges are worth noting. First, considerable effort was required to obtain current and valid home telephone numbers for many of the study participants. However, in spite of these challenges, we were able to achieve high response rates for each of the parent surveys. Second, the need to distribute home computers to treatment households as soon after random assignment as possible precluded us from conducting a baseline survey of study participants' computer experiences and skills. Third, the inability to adapt a third-party software program that tracks computer use prevented us from obtaining data that could be used to corroborate treatment parents' and students' assessments of the frequency of their home computer use. Finally, because there were not enough grant funds to administer technology assessments to all study participants, we limited our analysis of student achievement to grades and student scores on statewide assessments in mathematics and reading. In an effort to address concerns that these two commonly used measures might not be sensitive enough to detect changes in treatment students' computer skills, we piloted a series of technology use protocols in one study school. The purpose was to examine whether the SPARC intervention improved treatment students' abilities to use computers and the Internet for a range of education-related tasks.

Summary

As discussed throughout this chapter, a series of factors affected both the SPARC intervention and the study design. Most notably, the length of time required to hire a full-time SPARC program director and the need to distribute computers as early in the 2004–05 school year as possible made it difficult to proactively prepare for many of the interrelated activities that had to be concurrently implemented. In addition, the failure to recruit contiguous school districts ultimately hindered efforts to provide technical assistance in an expedient manner. The conditions of the federal grant and the limited timeframe also

[39]Specifically, none of the households that attended an orientation session declined to participate in the study.

affected the scope of the study design. For example, the need to recruit schools as quickly as possible precluded us from situating the intervention in classrooms where students were already making frequent and effective use of learning technologies.

Another factor that potentially affected the extent to which treatment group participants made use of the SPARC computers was the quality of the computers themselves. The findings described in this chapter suggest that at least one-third of treatment households experienced significant technical difficulties with their refurbished computers. What is not clear is whether these computer-related issues were a result of low-quality PCs, problems with the refurbishing process itself, problems associated with having treatment households load AOL on their SPARC computers, or other user-related problems (e.g., downloading too many software programs that diminished the PCs' processing capacity).

5. CHARACTERISTICS OF THE STUDY POPULATION

Only households that reported on the household recruitment survey that they did not have a working home computer were eligible to participate in the study.[40] This requirement resulted in a study sample that exhibited specific demographic and economic characteristics that set them apart from other students in their schools. For example, study participants were more likely than other students in their schools to be Hispanic or African American, participate in the free or reduced-price lunch program, and come from single-parent households. In addition, they were *less* likely to have parents who attended college, were employed, earned more than $30,000 per year, or spoke primarily English in the household.

Documenting the attributes of the study households informs the extent to which findings about the impact of SPARC can be generalized to a larger population. This chapter describes the characteristics of the study population and examines the extent to which participating households were similar to and different from other nonparticipating households in the 22 study schools. It also examines the academic environment within which the study was conducted. Although SPARC was an out-of-school intervention, the frequency with which teachers were making use of learning technologies in their classrooms was expected to influence the extent to which treatment students would make use of their home computers for educational purposes. The information presented in this chapter regarding teachers' instructional uses of computers and the Internet are therefore intended to place our findings on the impact of SPARC in an appropriate academic context.

It should be noted that this chapter makes reference to the characteristics of 4th graders and the instructional practices of 5th grade teachers. This simply reflects the point in time when various surveys were administered. Specifically, data about household characteristics were obtained through the household recruitment survey, which was conducted while study students were in 4th grade. Information about teachers' instructional practices and use of computers and the Internet was collected through a teacher survey that was administered while study participants were in 5th grade.

Household and Student Characteristics

This section describes the characteristics of several populations: the 676 households with a 4th grader in one of the 22 participating study schools that had a working home computer in May 2004, the 504 households that did *not* have a working home computer at the time the household recruitment survey was administered, and the 354 families that ultimately enrolled in the study. Comparing the characteristics of these three populations is critical to understanding both the overall context within which SPARC was implemented and the extent to which study findings can be viewed as being representative of what happens when 5th grade children are provided access to a home computer for the first time.

Characteristics of All Households with a 4th Grader in a Participating Study School

The SPARC study was conducted in 22 elementary schools across four Pennsylvania school districts. These schools were selected because they shared some common characteristics and agreed to provide data on participating 5th grade students. The families that completed the household recruitment survey generally reported low annual income and high rates of unemployment. Specifically, 23 percent of

[40] As discussed in Chapter 3, the fact that the household recruitment survey was administered prior to any publicity surrounding the SPARC study decreased the likelihood that respondents would misrepresent their home computer status.

the 1,180 families that completed the survey had no employed parent in the household, 72 percent had annual household incomes of under $30,000, and 81 percent reported that their 4th grade child was receiving free or reduced-price lunch (Table 5-1). In addition, 60 percent reported that neither parent had gone to college, with 22 percent reporting that neither parent had completed high school. In spite of these relatively high rates of poverty and low levels of educational attainment, the majority (57 percent) of respondents had a home computer that was in working condition at the time the household recruitment survey was administered. The remaining 43 percent reported that they did not have a working computer in their household and were therefore eligible to participate in the study.[41]

There were some major differences between households that did and did not have working computers at the time the survey was administered. Not surprisingly, respondents in households with computers tended to be better off financially and reported higher levels of educational attainment than those in households without computers.[42] For example:

- Households without computers generally had lower annual incomes than households with computers. For example, 51 percent of households without computers earned $15,000 or less over the past year, compared to 25 percent of households with computers. In addition, 13 percent of households without computers earned $30,001 or more in the past year, compared to 39 percent for households with computers. This finding may be related to the number of parents living in the household and parents' employment status—that is, 53 percent of households with computers had two parents living in the household, compared to 30 percent of households without computers.

- Households without computers were more likely than those with computers to have no employed parents (32 percent versus 16 percent).

- The proportion of 4th grade students receiving free or reduced-price lunches at school was higher for families without computers (91 percent) than for those with computers (74 percent).

- Parents in households with computers generally had higher levels of educational attainment than those in households without computers. For example, 49 percent of households with computers reported that at least one parent had attended some college, compared with 26 percent of households without computers. Conversely, 35 percent of households without computers reported that neither parent had a high school diploma, compared with 12 percent of households with computers.

[41] Over three-quarters (78 percent) of the households in the survey without a home computer reported that they did not have one because it was too expensive (not shown in tables). Other reasons provided were that the home computer was broken and needed repair, that computers and/or the Internet were inappropriate for young children, and that there was not enough space in the home to accommodate a computer. In addition, over half (57 percent) of respondents in homes without computers indicated that their 4th grader used computers outside of school—e.g., at a friend or relative's house (28 percent), at a public library (28 percent), at a community center (3 percent) and/or at an after-school program (2 percent).

[42] These findings in this section should not be taken to imply a causal relationship between owning a home computer and household characteristics, student grades, or parental involvement. More likely, the findings uncovered by the household recruitment survey reflect a wide range of economic and social factors that may directly or indirectly affect a family's ability and inclination to purchase and make use of a home computer.

Table 5-1.—Characteristics of *all* households with a 4th grade student in participating schools

Household characteristic	Total (N=1,180)	Households with working computers (N=676)	Households without working computers (N=504)
Household composition*			
Two-parent household	43%	53%	30%
One-parent household	50	41	63
No-parent household	7	7	7
Poverty level*			
Child received free or reduced-price lunch	81	74	91
Household income in past year*			
15,000 or less	36	25	51
15,001 to 30,000	36	37	36
30,001 to 45,000	15	21	8
45,001 to 60,000	8	11	4
60,001 to 75,000	3	4	1
Over 75,000	2	3	†
Highest level of education among parents in household*			
Less than high school diploma	22	12	35
High school diploma or equivalent	38	38	39
Some college/vocational degree/associate's degree	34	40	25
Bachelor's degree	5	8	1
Graduate degree	1	1	†
Parents' employment status*			
Two employed parents in household	24	34	13
One employed parent in household	53	51	55
No employed parents in household	23	16	32

* $p \leq .05$.

†Rounds to zero.

NOTE: Percents may not sum to 100 because of rounding.

SOURCE: eSPARC Household Recruitment Survey, 2004.

There were also significant differences in the characteristics of 4th grade students who did and did not have access to a home computer. Students in households with computers received better grades on average (as reported by parents) than those without home computers (Table 5-2). Further, students in households with computers were less likely than those from households without computers to be enrolled in an English as a second language program (12 percent versus 18 percent) and special education or special needs classes (17 percent versus 24 percent). They were also less likely to reside in a household where Spanish was the primary language.

These findings are similar to national data on access to technology that consistently show that the presence of home computers is closely tied to household income levels. For example, data from the 2000 U.S. Census indicate that among households with incomes of $75,000 or more, 88 percent had at least one computer, while only 28 percent of households with incomes below $25,000 had a computer (Newberger 2001). Furthermore, data from the National Center for Education Statistics found that children from low-

income families, particularly those at the lowest grade levels (i.e., kindergarten and first grade), were least likely to have access to home computers (Rathburn and West 2001).

Table 5-2.—Characteristics of *all* 4th grade students in participating schools

Student characteristic	Total (N=1,180)	Households with working computers (N=676)	Households without working computers (N=504)
Grades in school*			
Earns mostly As in school	30%	37%	20%
Earns mostly Bs in school	43	43	44
Earns mostly Cs in school	22	17	28
Earns mostly Ds or lower in school	5	3	8
Average number of minutes spent on homework on average school days	71	70	73
Enrollment in programs			
Enrolled in honors, gifted, or advanced placement classes	14%	16%	12%
Enrolled in English as a second language program*	15	12	18
Enrolled in special education or special needs classes*	20	17	24
Race/ethnicity*			
White	17	22	10
African American	34	32	36
Hispanic/Latino	37	33	41
Asian or Pacific Islander	2	2	1
Some other race	11	11	12
Language spoken most at home*			
English	83	87	79
Spanish	8	5	11
Another language	1	1	1
English and Spanish or another language equally	7	7	8

* $p \leq .05$.

NOTE: Percents may not sum to 100 because of rounding.

SOURCE: eSPARC Household Recruitment Survey, 2004.

Characteristics of Study Participants

Only those households that lacked access to a working home computer were eligible to participate in the SPARC study. As the preceding discussion suggests, the students from these households tended to be poorer than the overall student population. At the beginning of the study, 62 percent of participating students lived in single-parent households (Table 5-3). For most households (71 percent), the highest level of education attained by either parent was a high school diploma or less. While 14 percent of households had two employed parents (either full or part time), 56 percent of households had one employed parent, and 30 percent had no employed parents. Most participating students (87 percent) lived in households that earned $30,000 or less each year, and 92 percent received free or reduced-price lunch at school. Half (51 percent) had parents who reported no computer use in the month preceding the household recruitment survey. In addition, as shown in Table 5-4:

- Most of the students who participated in the study were Hispanic/Latino (42 percent) or African American (33 percent).

- While English was reported to be the language spoken by most students at home, 13 percent primarily spoke Spanish at home, and 9 percent spoke English and Spanish or another language equally.

- According to parent reports, 64 percent of participating students earned mostly As or Bs during the 4th grade, while 31 percent earned mostly Cs, and 6 percent earned mostly Ds or lower.

- During 4th grade, 14 percent of study participants were enrolled in honors or gifted classes, 19 percent were enrolled in English as a second language (ESL), and 24 percent were enrolled in special education or special needs classes.

Table 5-3.—Characteristics of households participating in the SPARC study

Characteristic	Total (N=354)	Treatment (N=178)	Control (N=176)
Household composition			
Two-parent household	32%	35%	28%
One-parent household	62	60	65
No-parent household	6	5	7
Highest level of education among parents in household			
Less than high school diploma	35	37	34
High school diploma or equivalent	36	35	37
Some college/vocational degree/associate's degree	27	25	29
Bachelor's degree	1	2	0
Graduate degree	1	1	0
Parents' employment status			
Two employed parents in household	14	15	12
One employed parent in household	56	51	61
No employed parents in household	30	34	27
Household income in past year			
15,000 or less	51	50	53
15,001 to 30,000	36	37	36
30,001 to 45,000	8	10	6
45,001 to 60,000	4	3	4
60,001 to 75,000	0	0	1
Over 75,000	0	0	1
Poverty level			
Child received free or reduced-price lunch	92	93	91
Parent use of computers			
Not at all	51	51	51
1 to 2 days per week	12	14	11
3 to 4 days per week	7	8	6
5 or more days per week	30	27	32

NOTE: There were no statistically significant differences between treatment and control for any of the variables in the table. Percents may not sum to 100 because of rounding.

SOURCE: eSPARC Household Recruitment Survey, 2004.

Table 5-4.—Characteristics of students participating in the SPARC study

Characteristic	Total (N=354)	Treatment (N=178)	Control (N=176)
Race/ethnicity of student			
Hispanic/Latino	42%	40%	45%
African American	33	33	33
White	11	12	10
Asian or Pacific Islander	1	2	0
Some other race	12	12	11
Language spoken most at home by student			
English	78	79	77
Spanish	13	12	13
English and Spanish or another language equally	9	7	10
Another language	1	2	1
Grades in school (4th grade)			
Earns mostly As in school	19	20	18
Earns mostly Bs in school	45	50	40
Earns mostly Cs in school	31	25	36
Earns mostly Ds or lower in school	6	6	5
Enrollment in programs (4th grade)			
Enrolled in honors, gifted, or advanced placement classes	14	11	16
Enrolled in English as a second language program	19	21	18
Enrolled in special education or special needs classes	24	25	24

NOTE: There were no statistically significant differences between treatment and control for any of the variables in the table. Percents may not sum to 100 because of rounding.

SOURCE: eSPARC Household Recruitment Survey, 2004.

As would be expected from a random assignment study, there were no statistically significant differences between the treatment and control groups with respect to any of the household, student, or parent characteristics that were examined. Additional data from the fall 2004 parent and student surveys, administered 1 month after the SPARC computers were distributed to treatment group households, demonstrate that the treatment and control groups were also similar with respect to school-related measures (Kleiner, Silverstein, and Zhang 2005). Generally, students from both groups had similar attitudes toward school and computers, had performed equally well on 4th grade report cards, and behaved in similar ways both at school and at home. Parents from the treatment and control groups were equally involved in their children's education and had very similar views about computers.

School and Classroom Characteristics

As discussed in Chapter 2, there is ample evidence that school and classroom environments (especially environments rich in educational technology) influence the extent to which students use their computers at home for academic purposes. Students with teachers who make use of and model technology for educational purposes are more likely to have the knowledge, confidence, and desire to use their home computers for school work and other learning pursuits (International Society for Technology in Education 2002).

Although SPARC was an out-of-school intervention, the original intent was to conduct the study in schools that were making frequent use of learning technologies. However, as discussed in Chapter 3, this

desired criterion was ultimately supplanted by a need to select schools that (1) had a high concentration of students from low-income households (to maximize the number of students who would lack access to a home computer), and (2) were willing to provide the necessary student-level data. As a result, many of the schools that were selected to participate in the study were not regularly using computers or the Internet with their students. This finding is noteworthy, since it suggests that many of the treatment group students who gained home access to a computer and the Internet did so without the benefit of an academic framework that emphasized the value and use of these learning tools.

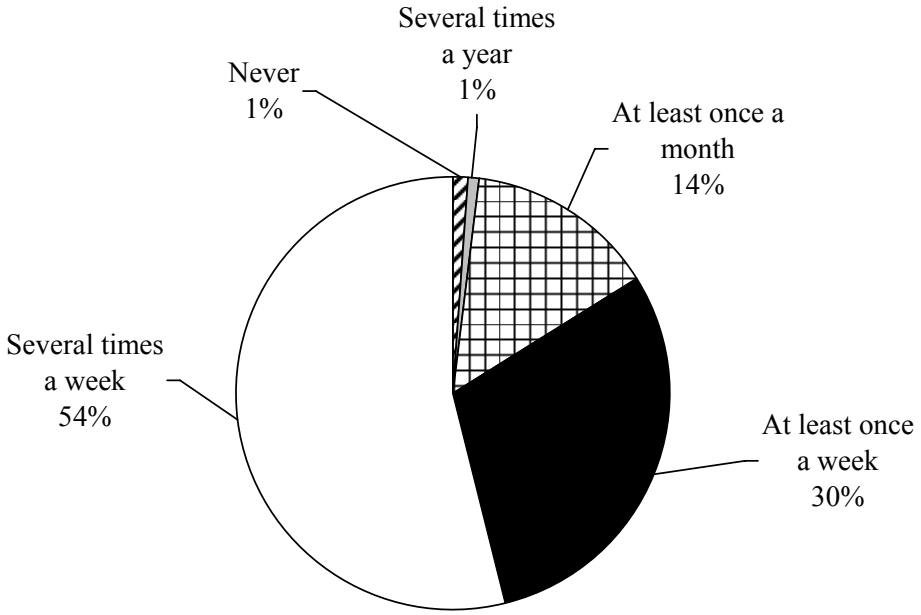
This section describes the school context within which the SPARC study was conducted. In so doing, it examines the frequency with which teachers made use of various learning technologies in their classrooms, and the extent to which teachers believed that computers and the Internet have the potential to enhance student learning and achievement.

Extent to Which Teachers Utilized Computers and the Internet with Their 5th Grade Students

According to results from the teacher survey, the average study participant was enrolled in a classroom that had six instructional computers/laptops, almost all of which had Internet access, for use by approximately 20 students (not shown in tables). Most of the 5th grade teachers in participating study schools reported using computers and/or the Internet with their students several times a week (54 percent) or at least once a week (30 percent) (Figure 5-1). However, as shown in Table 5-5, teachers were primarily using computers for performing practice tutorials or drills (individual and/or whole class)—32 percent of teachers said that they assigned tutorials or drills several times a week. Other assignments involving computers and/or the Internet were more infrequent. For example, 39 percent of teachers asked students to type a story or report using a word processing application at least once a month, while half did this several times a year (41 percent) or not at all (11 percent). Only 40 percent of teachers had students conduct research using the Internet at least once a month, with the majority requiring that their students use the Internet several times a year (51 percent) or not at all (9 percent). Other types of computer use, such as using drawing or painting software, displaying information using charts or graphs, and performing calculations with computers or spreadsheets, were even more infrequent.

Even when students were making use of computers at school, teachers rarely assigned homework involving computers or the Internet. Only one-fourth of the 5th grade teachers in the study schools assigned computer-related homework on a monthly (16 percent) or weekly (10 percent) basis (Figure 5-2). The majority (54 percent) reported that they never assigned homework involving computers or the Internet. In some schools, this reluctance may have reflected teachers' concerns that some of their students did not have easy access to a computer outside of school.

Figure 5-1.—Extent to which 5th grade teachers in study schools used computers and the Internet with their students



SOURCE: Teacher Survey, spring 2005.

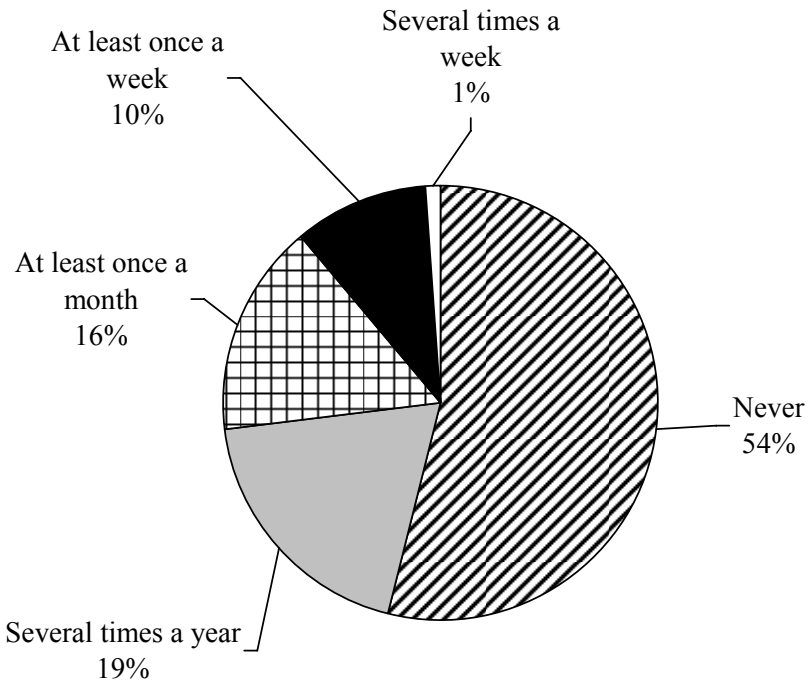
Table 5-5.—Frequency with which 5th grade teachers in study schools assigned computer and Internet-related tasks to their students

Task	Several times a week	At least once a week	At least once a month	Several times a year	Never
Perform practice tutorials or drills	32%	25%	12%	13%	17%
Type a story using a word processing application	3	6	39	41	11
Conduct research using the internet	6	9	25	51	9
Use drawing or painting software	1	1	3	25	69
Display information using charts or graphs	0	0	0	38	63
Perform calculations using computers or spreadsheets	3	3	0	19	75

NOTE: Percents may not sum to 100 because of rounding.

SOURCE: Teacher Survey, spring 2005.

Figure 5-2.—Extent to which 5th grade teachers in study schools assigned homework that required the use of computers and/or the Internet



SOURCE: Teacher Survey, spring 2005.

Teachers' Educational Philosophy Regarding Computer Use

Overall, the 5th grade teachers in the study schools held quite positive views about the potential of computers for educational purposes. As shown in Table 5-6, the majority strongly agreed that educational technology helps students search for and communicate information effectively (62 percent), promotes self-motivated learning and a sense of exploration (62 percent), and enhances the curriculum and connects it to real-life situations (61 percent). In addition, almost all strongly or somewhat agreed that it allows for more individualized instruction, contributes to students' increased interest in school, engages students in challenging and authentic tasks, and develops critical and creative thinking skills. Half (49 percent) believed that educational technology encourages parental involvement in the learning process while 71 percent disagreed that computers take away classroom time best spent on other activities.

Table 5-6.—Views of 5th grade teachers in study schools about the educational impact of integrating learning technologies into classroom instruction

Impact	Strongly agree	Somewhat agree	Somewhat disagree	Strongly disagree
It helps students search for/communicate information effectively	62%	33%	4%	1%
It promotes self-motivated learning and a sense of exploration	62	33	3	3
It enhances the curriculum and connects it to real-life situations	61	37	0	3
It allows for more individualized instruction	49	40	7	4
It contributes to students' increased interest in school	46	45	8	1
It engages the students in challenging and authentic tasks	46	48	4	3
It develops critical and creative thinking skills	41	48	10	1
It encourages parental involvement in the learning process	8	41	33	19
It takes away classroom time best spent on other activities	0	30	36	35

NOTE: Based on the 81 teachers who completed the teacher survey. Percents may not sum to 100 because of rounding.
SOURCE: Teacher Survey, spring 2005.

Barriers to Integration of Educational Technology Into Classroom Instruction

Teacher survey findings also shed light on why the 5th grade teachers in the study schools were making so little use of computers and the Internet with their students. As shown in Table 5-7, most teachers reported that overly complicated software (94 percent) and computers (92 percent) served as major or moderate obstacles that prevented them from taking full advantage of computers and the Internet in their instruction. Other major or moderate barriers cited by more than half of all teachers included inadequate electrical wiring (78 percent), too few computers with Internet access (71 percent), inadequate computer-related training for teachers (69 percent), lack of instructional software (63 percent), slow or unreliable Internet connections (61 percent), and inadequate hardware upkeep and repair (59 percent). It is worth noting that only 42 percent cited a lack of time in the school schedule as a major or moderate barrier, and only 26 percent cited the competing demands of curriculum or mandated tests.

Table 5-7.—Views of 5th grade teachers in study schools about barriers to using computers and the Internet with students

Barrier	Major extent	Moderate extent	Minor extent	Not at all
Software too complicated to use	65%	29%	5%	1%
Computers too complicated to use	64	28	6	1
Inadequate electrical wiring	58	20	15	8
Too few computers with Internet access in the building	47	24	14	15
Inadequate computer-related training for teachers	33	36	23	9
Lack of instructional software	33	30	18	19
Slow or unreliable Internet connections	30	31	19	20
Inadequate hardware upkeep and repair	26	33	21	20
Lack of time in school schedule to use computers	21	21	31	26
Lack of working computers	16	25	30	29
Demands of curriculum or mandated tests	8	18	30	45

NOTE: Based on the 81 teachers who completed the teacher survey. Percents may not sum to 100 because of rounding.
SOURCE: Teacher Survey, spring 2005.

Summary

The recruitment process for the SPARC study was designed to identify schools with a high percentage of households that were unlikely to own a home computer. It is therefore not surprising that the 22 elementary schools that elected to participate in the study were located in neighborhoods characterized by high rates of poverty and unemployment. Nonetheless, home ownership of computers in these elementary schools was higher than expected, with 57 percent of households with a 4th grader reporting a working home computer in the months preceding random assignment. There were also significant differences between those 4th grade students who did and did not have access to a working home computer. For example, the 43 percent of 4th grade students who did not have a working computer at home were significantly more likely to live in low-income homes with only one parent. They were also more likely to be Hispanic/Latino or African American and live in a household in which no parent was employed.

The use of a passive intervention was not accidental in that SPARC was designed to assess the impact of a low-cost, home-based technology initiative. As such, it was viewed as an opportunity to examine the impact of a commonly used technique for addressing the digital divide. Nonetheless, it is important to note that the minimal use of learning technologies in the classrooms, as well as the lack of any homework assignments that encouraged or required computer and Internet use, decreased the likelihood that treatment students would make use of their SPARC computers for academic purposes.

All of the 22 elementary schools that participated in the study were equipped with computers and Internet access. Most of the 5th grade teachers in these schools were enthusiastic about the potential of computers for educational purposes. Nonetheless, it appears that the extent to which teachers made use of computers and the Internet with their 5th grade students was limited by a number of barriers. Even more notable for the SPARC intervention, most of the teachers with students in the study were reluctant to require computer or Internet use for homework assignments, because they believed that many of their students had limited access to computers outside of school. In addition, as is discussed in the next chapter, few families took advantage of the voluntary technology skills training that was made available to treatment families throughout the 2004–05 school year. As such, it is reasonable to characterize the SPARC initiative as a "passive" intervention—that is, treatment group students took possession of their home computers in an environment that lacked a systematic requirement that they be used for school-related or academic purposes.

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6. FINDINGS ON THE SPARC INTERVENTION

Students assigned to the treatment group received a refurbished Dell Pentium II/III computer, a printer, a pair of speakers, and free dial-up Internet access through America Online. Treatment group families also had access to several technical assistance activities made available through the Carbon Lehigh Intermediate Unit—including toll-free technical assistance for computer-related questions or problems, a website that provided links to educational sites, a monthly newsletter, and the opportunity to participate in monthly training sessions about how to make use of specific computer applications.[43]

This chapter focuses on whether treatment households made use of the services made available through SPARC. This examination of the SPARC intervention is important for both theoretical and practical reasons. From a theoretical perspective, the underlying research questions that this study is designed to address rest on the assumption that the impact of the SPARC intervention would increase as a result of increased exposure to—*and use of*—computers and the Internet. Therefore, examining whether household members actually used their SPARC computers represents an important step in understanding any observed impacts (or lack thereof) on student learning and parental involvement.

Within this context, this chapter examines the extent to which treatment households made use of their home computers and the other services made available through the SPARC intervention. It also describes students' and parents' opinions of the benefits of gaining home access to a computer and the Internet.

While most of the findings presented in this chapter rely on data collected during the 8-month intervention, additional information is provided about the experiences of a small number of treatment parents who participated in the parent focus groups. Findings from the focus groups are meant to complement the quantitative findings and to portray in greater detail the use of computers within the treatment households. In reviewing this chapter, it should therefore be noted that survey data reflect findings for *all* treatment parents and students, while focus group data (provided in call-out boxes) only reflect findings for two small groups of treatment parents.[44]

Extent to Which Households Made Use of SPARC Benefits

At the outset of the study, most student and adult participants were visibly excited at the prospect of gaining access to a home computer and Internet access. In addition, many parents expressed interest in attending technology-related training sessions that would enhance their capacity to use their home computers. This section provides information on the extent to which students and parents actually made use of their home computer and the other services made available through SPARC.

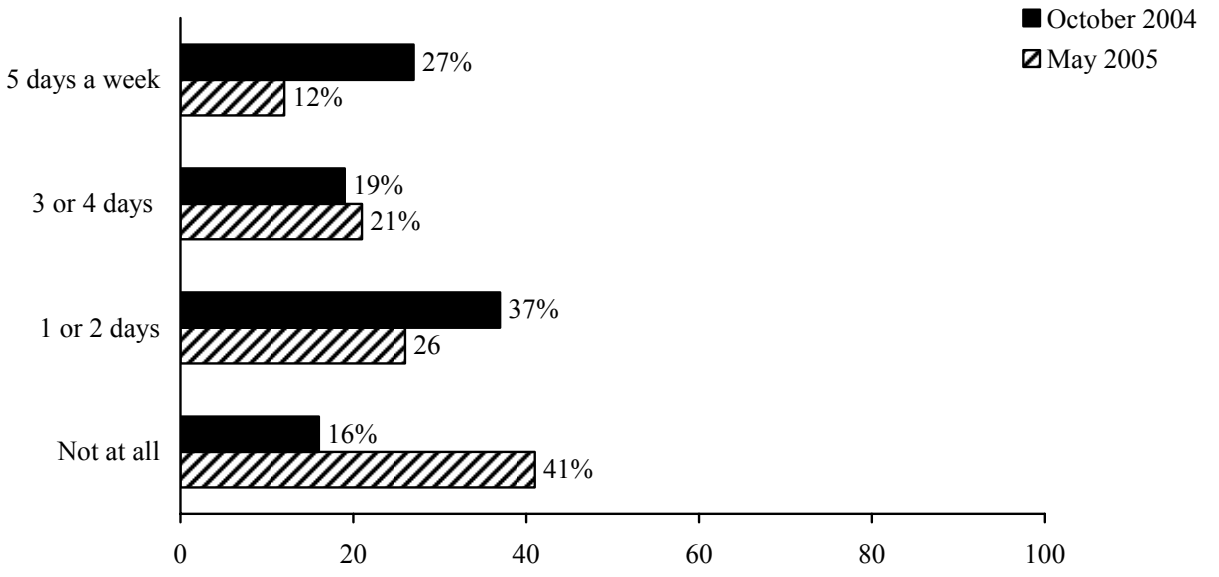
[43]As discussed in Chapter 3, both treatment and control students also received several CD-ROMs that contained training materials. However, because these CD-ROMS were provided to study participants after the 2004–05 school year, they are not discussed in this chapter.

[44]Most focus group findings presented in this chapter are from the July 2006 sessions. As discussed in Chapter 3, the criteria used to select parents for the July 2006 sessions were designed to identify treatment households in which (1) at least one study participant (i.e., a parent or the 5th grade student) reported in spring 2005 that he/she was making moderate or frequent use of the SPARC computer, (2) at least one parent was reported to be regularly checking that the 5th grade child was completing his or her homework assignments, and (3) English was the primary language spoken in the home (to facilitate the focus group sessions in English).

SPARC Computers

One month after receiving their SPARC computers, 46 percent of treatment students reported using their SPARC computers 3 or more days during the previous school week, while 16 percent said that they had not used their computers *at all* during the previous school week (Figure 6-1). By the end of the 2004–05 school year (May 2005), only one-third (33 percent) of treatment students reported using their SPARC computers 3 or more days during the previous week, and the proportion who reported not using their SPARC computers at all rose to 41 percent. Similarly, 40 percent of treatment students in May 2005 reported that they had not used their SPARC computers during the previous weekend, compared with 21 percent in the fall of 2004 (not shown in tables). The finding that many treatment students were spending less time on their SPARC computers by the end of the 2004–05 school year may have been due to a number of conditions, including the decreased novelty of having a home computer, problems with the functionality of their SPARC computer, and/or a realization by treatment parents and students that they could gain faster and more reliable access to the Internet at other locations.

Figure 6-1.—Frequency with which treatment students reported using their SPARC computers in the previous school week



NOTE: Percents may not sum to 100 because of rounding.

SOURCE: eSPARC October 2004 Student Survey and May 2005 Post-Intervention Student Survey.

Summer 2006 Parent Focus Groups:
How Students Used the SPARC Computers for School-Related and Recreational Purposes

Parents who attended the Summer 2006 Parent Focus groups reported that their children used their SPARC computers for playing games, learning typing/keyboarding, surfing the web for personal interests, writing school reports, spelling, downloading music, e-mailing and instant messaging, and developing PowerPoint presentations. When asked what websites their children frequented, parents responded with an array of examples, including Walt Disney, Nickelodeon, NBA.com, Kaaza (music downloads), Cartoon network, BET, MTV, Yahoo, Music Launch, Star.com, Baltimore Orioles, NASA, drawing and painting sites, and gaming sites (e.g., Pogo, car racing).

All of the parents noted that the SPARC computers were used far more often for recreational purposes than for schoolwork. Nonetheless, parents described a variety of ways in which the SPARC computers were used by their students for school-related purposes. For example, most parents reported that their children made use of the technology for school reports and essays. Specifically, they used the SPARC computer to search for information on the Internet on such topics as the Statue of Liberty, Puerto Rico, cheetahs, and Rosa Parks. One parent remarked that the amount and type of information her son could collect from the Internet affected his grades: "The biggest advantage for my son was helping him with his reports, like [the computer] had a lot of excellent information, and his last report that he did was on mountains. He got a 98 percent—he printed out pictures off the Internet."

Parents also listed educational games that their children played on the SPARC computers, including Math Munchers, Bumblebee (spelling), WordWhomp, and Twenty-four (math-related). One parent said her child was currently "putting together Pennsylvania" in an online jigsaw puzzle map. When asked whether computing time had affected their children's other social activities like playing with friends, most parents said it had not. However, many parents indicated that having a home computer had cut down on their children's television viewing.

Parents estimated that at least 80 percent of their 5th grade children's use of the SPARC computer was for recreational purposes. Although there was some parental dismay that children used their computers primarily for recreation, parents were not overly critical of this use. In fact, some parents found educational merit in games even when they were not explicitly educational in nature, suggesting that the games "challenge" their children because they are "trying to beat the computer, and that automatically sharpens the way you think." Furthermore, some parents said that computer games improve hand-eye coordination, reaction time, and concentration, and arouse curiosity. One parent reported that playing games increases a child's patience, since "you have to be patient to get to the higher level" in the game. Another parent thought that game playing was at least a better alternative than going outside or visiting chat rooms:

> *And if you think of it another way, it is better for a kid to be occupied that way, instead of you don't have anything to do. You know, you are not there, you are busy working. The kid will think of something negative you know, maybe go out in the streets or do something.*
>
> *But then, they may be in a chat room and they don't know who they are talking to, so I think it is better off for them to waste their time on games or on something else from school instead of being in there. I don't trust that chat room.*

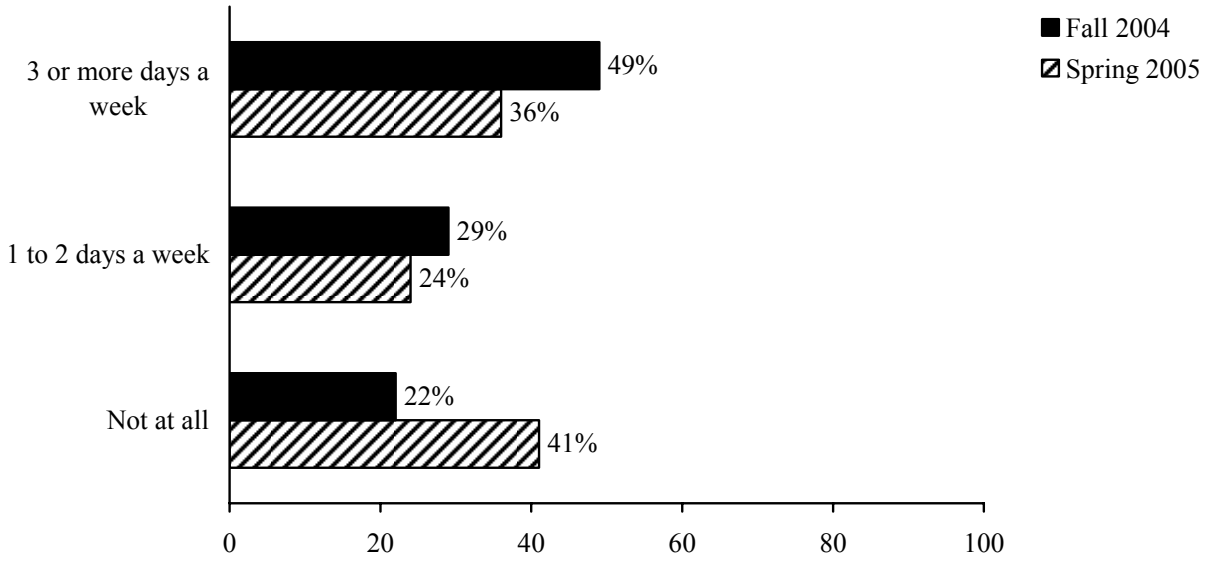
Summer 2006 Parent Focus Groups:
How Students Used the SPARC Computers for School-Related and Recreational Purposes
(continued)

In talking with the parents, most said their children had picked up quickly on how to make use of the computer, many times progressing from simple word processing and keyboarding to more varied use. One parent in particular, originally from Africa, described his son's progression with computing:

> *....he had no computer skills when he came over here, so in fact that was the first thing, that was the first computer he laid hands on. So that was great for him. Originally, it was to improve his typing skills using the keyboard and stuff. Then he used it to do assignments. Then all that transitions into using the Internet now for different things, sports, reading news, and different stuff you know… Any assignment that is from school, it goes into the computer, especially if it is some research for a core subject…I can't imagine him parting with that computer right now.*

Data collected from treatment parents revealed similar usage patterns. In fall 2004, 49 percent of parents reported having used their SPARC computers 3 or more days in the past week, while 22 percent reported not having used their SPARC computers at all in the previous 7 days (Figure 6-2). By spring 2005, this pattern had changed dramatically—only 36 percent used their SPARC computer 3 or more days in the past week, and 41 percent had not used it at all in the previous 7 days. It is worth noting that only 24 percent of treatment parents reported not having used a home computer in the previous *month* (see Table 8-2 in Chapter 8). This suggests that at least some of the parents who reported not using their SPARC computer in the previous week had made use of a home computer in the past month.[45]

Figure 6-2.—Frequency with which treatment parents reported using their SPARC computer in the previous week



NOTE: Percents may not sum to 100 because of rounding.

SOURCE: eSPARC fall 2004 Parent Survey and spring 2005 Post-Intervention Parent Survey.

[45]It is also worth noting that in 16 treatment households, both the student and parent reported that they had not made any use of their SPARC computer in the previous week. Among these 16 households, 9 reported in July 2005 that their SPARC computer was not working at all.

Summer 2006 Parent Focus Groups:
Parental Use of the SPARC Computers

During the focus groups, parents confessed to using the SPARC computer as much as or more than their children. Primary uses were game playing, job searching, and typing documents. Secondary uses were getting the news and weather, researching personal interests, making reservations (e.g., for hotels and/or vacations), paying bills, and banking.

While parents enjoyed a variety of computer games and card games (e.g., spades, canasta, black jack, Texas Hold 'Em, poker, bingo), they used their SPARC computers for career or professional purposes. For example, several parents routinely visited a website called Career Link online that provided them with information about current jobs, resume preparation, and training programs. In addition, parents posted their resumes and filled out applications online. One parent helped residents at a women's shelter where she volunteered find employment online; another parent, who is a medical assistant, commonly searched local hospitals for jobs; a third worked in the school system and frequently scanned the school district site for new openings. Parents preferred job searching on the web, since it had more listings than the newspaper, and they could send out unsolicited resumes simply by viewing company websites.

Some parents used the computer for typing documents, both for professional and recreational purposes. A few attended college classes and typed up reports; one typed CD covers for home-made CDs; another wrote newsletters for the Girls Scout troop she led. A 5th parent entered numbers in a table for her job as an attendance officer. Relative to their obtaining news and weather, parents told us that, for the most part, reading about these topics online did not replace their reading of the newspaper. Despite the fact that online news was more convenient than paper ("you do not have to worry about throwing it out"), most liked that the web format provided additional detail that a paper version could not accommodate. For example, one parent used to live in Shreveport, LA, and saw on the news that there was a bear loose in that area. Curious to see if the animal was near his old house, he connected to an Internet newspaper and found a map of the region that showed the bear's precise path. Another parent enjoyed reading online commentary on MSNBC that was typically not included in his local paper.

As for hobbies, parents visited many different types of sites. These included NASCAR, WWE (World Wrestling Entertainment), horoscopes, fashion websites, HDTV, NBA.com, arts and crafts sites, Mapquest, and bartending sites (one parent's occupation). Parents also visited sites aimed to help their children or enhance family activities. For example, one parent completed the FAFSA (Free Application for Federal Student Aid) online for her college-age son; another visited educational websites with her kindergartener so that she might get "bumped up to 1st grade early"; a third visited a hospital website to see pictures of her brother's newborn baby; and a fourth visited the school website to communicate with her son's teacher (a rare occurrence overall, we found). One woman described how she and her husband both kept tabs on their finances by logging into their bank account: "He [husband] has been going in there [online banking account] all the time and checking to see how much money is in the account because he knows I know how to get into it real quick. It's like five minutes—I got it, exactly how much it is, and it's shut down."

Summer 2006 Parent Focus Groups:
Parental Use of the SPARC Computers **(continued)**

Finally, we asked parents how their computing skills had changed. Since only one parent had ever owned a home computer previously, most parents explained that their skills were quite rudimentary when the SPARC computer had first arrived nearly 2 years ago. Now, they appeared proud of their newfound aptitude: "I actually know how to use one now!" "The eSPARC training taught me how to use it," and "I know how to download music." One parent explained her latest computing skills this way:

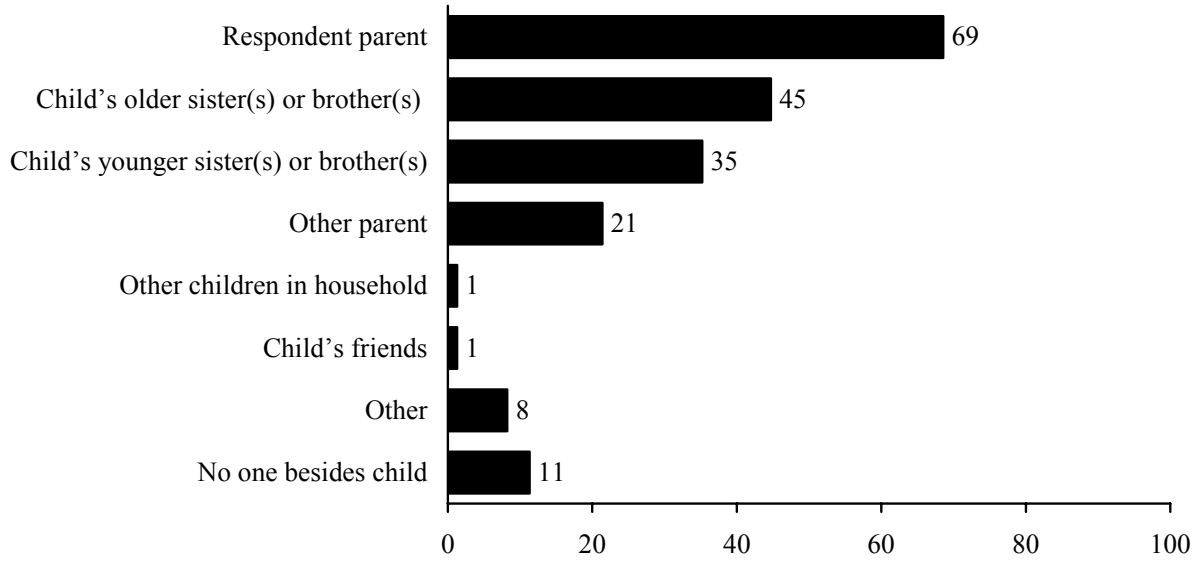
> *I didn't know anything about computers. My daughter called me computer illiterate. And I didn't get to go to that first class. All's they did was brought the computer home, set it up…[My son] was there and then my daughter came over and did the America Online. She said, "This is how you start it up, okay." Well by and by, she no longer calls me computer illiterate.*
>
> *(Interviewer) Really.*
>
> *Yeah, I say [to her] "You know I was on this spot and that spot," and she goes "MOM [surprised] , you know a lot!…"*
>
> *(Interviewer) Alright, well that's good. How long did it take you, do you think?*
>
> *Not long.*
>
> *(Interviewer) Until you were you feeling pretty comfortable?*
>
> *Not long at all. If I get on, and like the kids are there, then they would be there telling me. But then once I come home from work and it was nice and quiet, and everybody was sleeping, then if I messed up, then nobody could say, "Ha, Ha."*

Most parents expressed some degree of satisfaction in what they learned or were able to do with the home computer. They understood, perhaps much better than they did before they received a home computer, that the machines were "always going to be a necessity no matter where you go," and that "if you want to get a job, pretty soon you're going to have to need to know how to operate a computer." All parents agreed that computers were indispensable, and a few went on to say that they would now "die without a computer" or "have withdrawal."

Treatment parents were also asked who in their household (besides their 5th grade student) regularly used the SPARC computer. Most (62 percent) indicated that they regularly used the computer, while many reported that an older (46 percent) or younger (40 percent) sibling did so (Figure 6-3).[46] Only 7 percent indicated that their 5th grade student was the only household member who used the SPARC computer on a regular basis. The finding that multiple household members regularly made use of the SPARC computer may reflect the decision of many parents to locate the machines in a public space within their homes, with almost two-thirds reporting that their SPARC computer was located in a living room or family area (43 percent), or in the kitchen or other dining area (21 percent). However, as shown in Figure 6-4, 22 percent of parents reported that the SPARC computer was in their 5th grade child's bedroom.

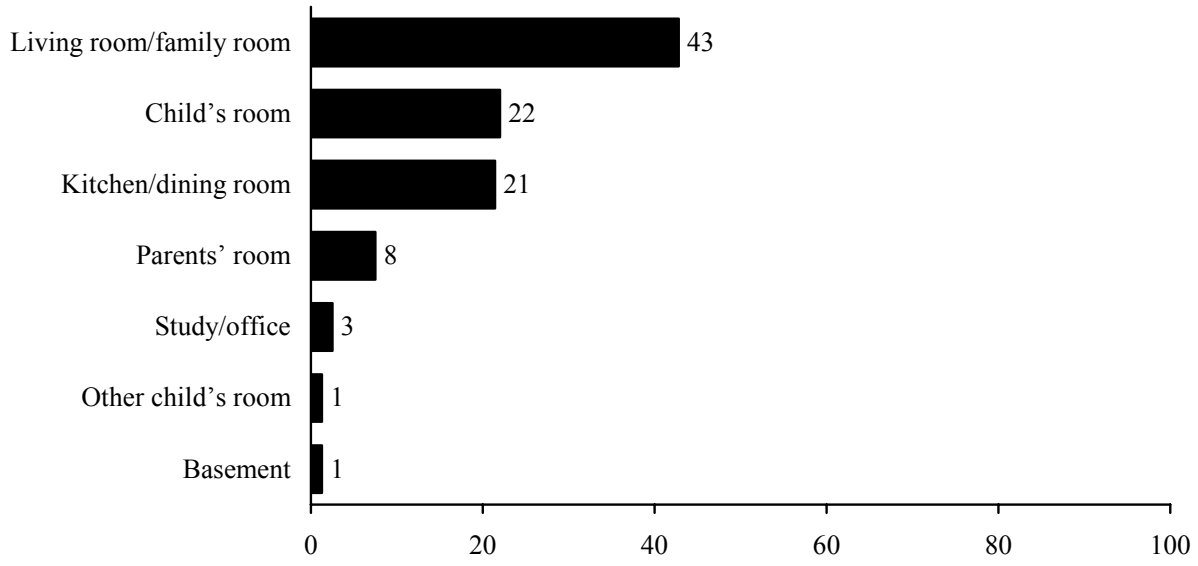
[46]There were no significant differences between the fall 2004 and spring 2005 responses to this survey item.

Figure 6-3.—Percentage of treatment parents reporting who in their household, besides their SPARC student, used the SPARC computer regularly



SOURCE: eSPARC spring 2005 Post-Intervention Parent Survey.

Figure 6-4.—Percentage of treatment households with SPARC computers in various locations



SOURCE: eSPARC fall 2004 Parent Survey.

Summer 2006 Parent Focus Groups and York Case Study Sample:
Impact of the SPARC Computer on Family Relationships

There is some anecdotal evidence that communication within treatment families changed as a result of having a computer in the home. First, communication between students and parents was enhanced because there was a stimulus for conversation, primarily the content that students and parents were discovering on the web. One parent explained it this way: "You can see a child that cannot express himself, but then he goes to the computer and does something, comes back, and relates that to you….. [My child] watches you on the computer, and she comes back and asks you a question on that."

Another parent said that he now has time to work with his son on the computer: "Believe me, I don't have the time to go to the library even if I want to—that is reality. Well, because he has it there, I will have 10, 15, or 20 minutes to sit down and show him how to use it a little bit you know." A third parent who worked the late shift would get online at 3:00 in the morning when she got home, only to find an e-mail from her son: "[My child] sends me e-mails, he used to when I would get home from work' 'bout 3:00, 3:30 in the morning. I'd get online, and I'd read an e-mail from him: 'Mom, don't forget gym tomorrow' or something. He knows as soon as I come in the house, because there's peace and quiet…[I'd be] sitting there…"

Although the computer enhanced family communication, this interaction appeared to ebb and flow. Specifically, some parents described their children's gradual independence from them once the youngsters had gained a certain level of computing proficiency:

> *(Interviewer) Do you ever sit down with them, beside them, you know as they are working, playing games… sit down together or look up information together?*
>
> *(Parent 1) Once in a while.*
>
> *(Parent 2) Just if they want you. Honestly.*
>
> *(Parent 3) Now, they prefer you stay away; at the beginning, it was alright because they were learning from me—at the beginning it was alright to stay. Well like right now when he's focused on the thing, he doesn't want any…[interrupted]*
>
> *(Parent 4) My son, when he's on the computer, you say something to him, he looks at you like you said [referring to other parent], it's like you are disturbing him a little bit.*
>
> *(Parent 5) And they like the independence too, to show that you know that they can do it on their own, and believe me some things they can really do them good.*
>
> *(Parent 2) Better than us.*

We also talked to the students about possible changes in family relationships and communication. Most of the treatment students in the case study responded on the survey that they now got along better with their parents as a result of having a home computer. We asked students to elaborate on how such improvement occurred. Many of their explanations involved improved communications. Children spoke of grandparents sending them e-mails that they read with their parents, exchanging pictures with family members in e-mails, and playing two-person games with their mother or father. Moreover, children said their parents sometimes checked on what they were doing on the computer, and this supervision often generated subsequent conversation. Treatment group students and parents both asked a variety of computer-related questions of each other, seemingly unaware who was more computer-adept. Questions included how to print, "unfreeze" a website, get rid of pop-ups, and add and remove buddies from an AOL Buddy List. Several treatment children mentioned they also got along better with their siblings, because they "help them with the computer" or "play games together."

Summer 2006 Parent Focus Groups:
Where the SPARC Computer was Located Within the Household

The location of the computer tended to impact oversight, parental involvement, and communication. Most parents had set up the computer in the living area from the beginning, remarking that they could keep a "closer eye" on what their child was doing than if the machine were in the child's bedroom. Two parents who had initially allowed the computer to be set up in their children's bedroom had subsequently moved it to a common area, commenting that their children had stayed up entirely too late with it, prompting the relocation. The central location gave parents a perfect window into their child's activities and a front-row seat to supervise them:

> *We had the computer right in the dining room, so I mean normally, he goes up to his bedroom to do his homework. You see, he couldn't do that with the computer because it was downstairs. So that way I could see what he was up to, you know. That way I got to see more and more about his volcano science fair project and everything, you know what I mean. He looked these things up; he couldn't hide it up in his room. He's at that age now; you know that you got to knock when you come in his room. [Laughter]*

One parent said she could "look over the shoulder" of her children, while another explained, "My chair is here and the computer is right there. Whenever they go on the computer, I can just sit there and watch them." Still others said they limited the amount of time their children could spend on the computer if their pursuits were not school-related or they checked the computer for the child's website history—both actions made easier by having the computer nearby. Finally, parents said that the location of the computer made it easy for their children to ask them for help ("I had to help her a lot with looking for things and she didn't know how to spell the words").

As part of the spring 2005 survey, treatment parents were asked to provide an example of how they had used the SPARC computer with their 5th grade child in the previous week. As shown in Table 6-1, about half of respondents reported they had either not used the computer with their 5th grader (35 percent) or that their SPARC computer was not working (16 percent). The most common shared uses included helping with or checking homework (26 percent), playing computer games (10 percent), and looking up information on the SPARC computer or the Internet (9 percent). Exhibit 6-1 provides examples of treatment parents' responses for helping with or checking homework and looking up information.

Table 6-1.—How treatment parents reported using the SPARC computer with their 5th grader in the previous week

Use	Percent (N=137)
Helping with or checking homework	26
Playing computer games	10
Looking up information on the computer or Internet	9
Using computer graphics	2
Other	2
Nothing	35
SPARC computer not working/no longer in household	16

SOURCE: eSPARC spring 2005 Post-Intervention Parent Survey.

Exhibit 6-1.—Examples of how treatment parents reported using the SPARC computer with their 5th grade child in the previous week

Homework

- We were looking up the spelling of some words.
- Had a paragraph to do using different words and used spell check.
- Looked up websites for math homework.
- Did a science report for school, family tree, helped with math homework.
- I taught him how to go in to word processing and use spell check.
- Homework on a science project, math, and vocabulary.
- We have been using Net Tracker, an educational search engine where children can go with their parents.
- Went to sites (Google) to help with math.
- Help with social studies project.

Computer graphics

- We have done arts, we did drawings.
- Made PowerPoint slide for a younger cousin.
- We used it to make a Father's Day card.

Searching the Internet

- Searching for news, sports, entertainment, and games.
- We searched on the Internet for information for church.
- We looked for Nickelodeon.
- I showed him how to change from AOL to Google and how to find music.
- We looked at NBA.com.
- We research stuff that we hear on television. For example, we watched the news and then researched it on the Internet.
- Searching and playing on the Cartoon Network website graphs.
- Looked for information on how to make bean bags.

NOTE: Responses reflect notes taken by Westat telephone interviewers—that is, these are not direct quotes and may not reflect verbatim what parents said during the telephone interview.

Finally, 26 percent of treatment parents reported that they added a software program to their SPARC computer (not shown in tables). Among these households, the most common types of software added were related to entertainment (80 percent), education (69 percent), and work (26 percent) (Table 6-2). These findings suggest that study participants were taking proactive steps to customize and expand the capacity of their SPARC computers. However, as discussed previously, the addition of new programs without consideration of CPU capacity may have hindered the functionality of some of the refurbished PCs.

Table 6-2.—Type of software added by treatment households to their SPARC computer

Type of software	Percent (N=137)
For entertainment purposes	80
For your children's education	69
For your work	26
For household management, such as tax preparation software	12

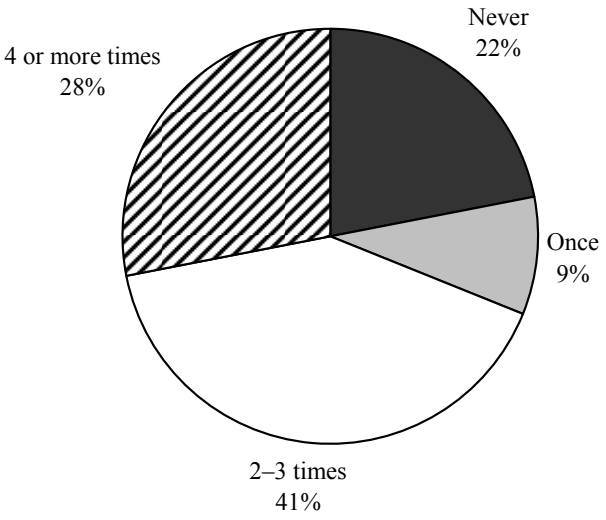
NOTE: This question was only asked of those treatment households that reported having added software to their SPARC computers, as opposed to all treatment households. Respondents could select more than one option.

SOURCE: eSPARC spring 2005 Post-Intervention Parent Survey.

Other SPARC Services

SPARC technical assistance helpline. Recognizing that treatment group households would have questions about and problems with their SPARC computers, the Carbon Lehigh Intermediate Unit maintained a bilingual (English and Spanish) helpline. Study participants were able to call this toll-free number during normal business hours to ask basic questions about computers and report problems with their SPARC PCs. By spring 2005, the vast majority (88 percent) of treatment parents reported that they knew about the technical assistance helpline. Of those who knew about the helpline, 28 percent had called four or more times, 41 percent had called two to three times, and 22 percent had never used it (Figure 6-5). Of those who had actually used the helpline, 49 percent indicated that the assistance they received was very useful, while 31 percent reported it was somewhat useful, and 20 percent said it was not at all useful (not shown in tables).

Figure 6-5.—Frequency with which treatment parents reported using the SPARC technical assistance helpline



SOURCE: eSPARC Computer Maintenance Survey, summer 2005.

Summer 2006 Parent Focus Groups: *Technical Assistance*

Several parents indicated that the technical assistance was not rendered in a timely manner. For example, one parent indicated that several months passed before her request was handled:

> *You know I called and it's now four months. "We'll get down in your area, we'll get down in your area." Well, I'm home every day you know it's not like they called and said we're here. You know I paid for extra things, I paid for Real Arcade, I paid for Cub Pogo for America Online, three different games for them [children] and I had to turn around and cancel everything because [it was not fixed]…*

Parents also noted that there did not appear to be enough technical assistance staff to deal with the number of computer-related problems that families encountered. One parent suggested that the program "needed more technical people…there were only like two of them and they had to cover all these…all three, four counties"; another said that "Every time that I call they're not in the office or I got to leave a message and they will never call me back"; a third said he resorted to paying for the fix himself:

> *First time I called, "I'll be in your area next week." Two weeks later, he is still not around, I called back, "I'll be in your area next week," 2 weeks later, he's still not there. It took months, and I finally just went and had somebody else. I paid and had it fixed because they never came.*

The number of households that reported problems with their SPARC computers is not reflected in the call records maintained for the SPARC help-line. As shown in Table 6-3, the most frequent technical support calls captured by the technical assistance log concerned problems with Internet connectivity, with the helpline receiving 49 calls (from 40 households) about lack of an Internet connection between October 2004 and April 2005. However, the helpline only recorded 32 calls (from 25 households) about computer applications or programs not working, 17 calls (from 15 households) regarding problems with America Online accounts, and 17 calls (from 13 households) about computers that would not start. The discrepancy between the number of calls to the Carbon Lehigh Intermediate Unit and the proportion of treatment families that described problems with their SPARC computers (as reflected in Table 4-1 in Chapter 4) could reflect several factors, including the inability of treatment households to connect with helpline staff (a problem that was recounted by many treatment group participants), a lack of interest on the part of some treatment group members to take proactive steps to repair their PCs, and/or a failure by technical staff at the Carbon Lehigh Intermediate Unit to record all requests for technical assistance.

Table 6-3.—Frequency and nature of technical support calls to the SPARC helpline: October 2004 to April 2005

Problem/issue/action	Total	Total number of households
Phone calls and e-mails		
Internet will not connect	49	40
A specific computer application is not working	32	25
How to use the computer, specific software, or the Internet	22	18
Problem with the America Online account	17	15
Computer will not start	17	13
How to set up the computer	11	10
Printer jammed/is not working	5	5
Internet interruptions/sudden disconnects	3	3
How to find a specific computer program or application	2	2
How to use a CD-ROM or floppy disk	2	2
Problem with the computer's modem	2	2
How to use virus detection or virus removal programs	2	1
Internet connection is slow	3	3
Home Visits		
Fix a computer	35	28
Swap a computer	16	16
Meet face-to-face with family about a PC-related issue	6	5

SOURCE: Technical assistance log.

The spring 2005 survey of parents also obtained information on other techniques that respondents had used to resolve computer-related problems. As shown in Table 6-4, the most frequently cited solutions included restarting the computer (89 percent), trying to solve the problem on their own (83 percent), asking the child for help (73 percent), and asking someone else in the family for help (68 percent). While there is no way to link these solutions with the problems they were addressing, these findings do suggest that parents were using a combination of approaches (including the SPARC help-line) to fix problems as they arose.

Table 6-4.—Steps taken by treatment parents to resolve problems with their SPARC computer

Step	Percent (N=137)
Restart the computer	89
Try to figure out the problem and solve it myself	83
Ask child for help	73
Ask someone else in your family for help	68
Call the SPARC helpline	60
Ask a friend for help	42
Other	13

NOTE: Respondents could select more than one option.

SOURCE: eSPARC spring 2005 Post-Intervention Parent Survey.

Participation in the SPARC training sessions. Throughout the 2004–05 school year, the Carbon Lehigh Intermediate Unit also conducted a series of technology-related training sessions for treatment students and parents (see Chapter 3 for a description of these training sessions). Parents were made aware of the monthly trainings by way of the newsletters and the SPARC website. However, relatively few treatment parents and students attended the trainings—21 percent attended at least one training session, and only 5 percent attended more than one session (not shown in tables). As shown in Table 6-5, treatment parents cited two principal reasons for not attending the sessions—they had to work (34 percent), and the scheduled time was not convenient (28 percent). It should be noted that only a few parents indicated that their lack of attendance was due to not knowing about the session (4 percent), not having enough notice (2 percent), lack of child care (2 percent), inconvenient location (2 percent), or unclear (2 percent) or uninteresting (0 percent) topic. These findings suggest that the primary barrier was the time of day that training was provided (primarily school nights), although it is not clear whether parents would have been willing or able to attend weekend sessions.[47]

Table 6-5.—Treatment parents' reasons for not attending an SPARC computer training session

Reason	Percent (N=137)
Had to work	34
Time wasn't convenient	28
Was not informed about sessions	4
Didn't have child care	2
Not enough notice	2
Location wasn't convenient	2
Topic was not clear	2
Topic was not interesting	0
Other	26

NOTE: Respondents could select more than one option.

SOURCE: eSPARC spring 2005 Post-Intervention Parent Survey.

[47]Staff from Carbon Lehigh attributed the low attendance to parents' lack of available child care, apprehension about entering school buildings, and difficulty obtaining transportation.

Summer 2006 Parent Focus Groups: *Training*

Besides the need for higher quality computers, better technical support, and greater involvement by the teachers, a few parents recommended additional training for themselves, not just their children. One explained: "I think more training [is needed]…I mean the kids have it in school every day, but there are a lot of parents that don't know anything about what these computers do."

Another prominent suggestion for improving the SPARC intervention was to involve teachers in helping students make use of their home computers (e.g., "the teacher is crucial, very crucial"). Parents proposed that teachers involve students with the computers by supplying them with websites, assigning more projects that require use of computers, and generally giving students "guidance" on how to best utilize the resource.

During a January 2005 focus group, parents listed a number of reasons for why they did not attend a training session, including too little notice, having to be at work at the time the sessions were being offered, inclement weather, and lack of transportation. Based on these findings, staff from the Carbon Lehigh Intermediate Unit worked to address the low attendance rates by expanding their advertising efforts via the SPARC website, newsletter, and mailings to households; offering incentives to households that attended a training session; hiring and training additional district teachers to serve as session facilitators; increasing the number and times of training sessions; and varying the selection of the local school serving as the training site. As shown in Table 6-6, the combination of these activities appeared to result in an increase in attendance for the March 2005 session, although the number of attendees was still well below the program's goals for the voluntary training component.

Table 6-6.—Attendance for voluntary SPARC training sessions

Month	Total number of sessions offered	Total number of treatment families in attendance
December 2004	4	14
January 2005	4	2
February 2005	4	14
March 2005	11	21
April 2005	10	10
Total	33	61

NOTE: Total likely includes families that attended multiple eSPARC training sessions.
SOURCE: Carbon Lehigh Intermediate Unit.

SPARC website and newsletter. The parent surveys did not obtain any information about the extent to which treatment households used or benefited from the SPARC website or monthly newsletter. During the January 2005 parent focus groups, however, we did ask participants about whether they were aware of the website and, if so, whether they had made use of its resources. Most focus group participants knew about the SPARC website from several different sources, including program materials, the SPARC mouse pad, a training session, and the newsletter. However, only a few had actually visited the site, and the majority of parents did not know whether their children had been to the website. Similarly, only a few participants remembered receiving the initial SPARC newsletter.

Parent and Student Perceptions of the Benefit of Their SPARC Computers

Despite the experience of ongoing technical problems with the SPARC PCs in many treatment households, parents maintained extremely positive views about their home computers. In the spring of 2005, parents were asked whether the SPARC computer had a positive effect, a negative effect, or no effect on various aspects of their own lives and their children's lives. The results shown in Table 6-7 reveal that most parents thought the SPARC computer had a positive effect on the quality of their child's schoolwork (93 percent) and their overall confidence in their abilities (91 percent). Many believed that the computer had a positive effect on their child's interest in technology (85 percent), school (83 percent), and hobbies (78 percent). Over two-thirds of parents thought that the computer had a positive effect on their child's behavior at home (69 percent).

Table 6-7.—Treatment parents' assessment of how the SPARC computer had influenced their 5th grader and other household members

Assessment	Positive effect	No effect	Negative effect
The quality of SPARC student's schoolwork	93%	8%	0%
The SPARC student's overall confidence in his/her abilities	91	8	2
The SPARC student's interest in technology	85	14	1
The SPARC student's interest in school	83	17	0
Child's interest in hobbies	78	22	1
Child's behavior at home	69	27	4
Your involvement in child's education	87	13	0
Your work-related skills	67	32	2
Other child's/children's interest in school	85	14	1
The quality of other child's/children's schoolwork	83	16	1

NOTE: Percents may not sum to 100 because of rounding.

SOURCE: eSPARC spring 2005 Post-Intervention Parent Survey.

Many parents also credited the SPARC computer with having a positive effect on their own involvement in their children's education (87 percent) and on their own work-related skills (67 percent). Parents with more than one child appeared to believe as well that the computer had an influence on their other children—85 percent said the computer had a positive effect on their other children's interest in school, and 83 percent thought that the computer had a positive effect on the quality of their other children's schoolwork.

Summer 2006 Parent Focus Groups:
Advantages of Having a Home Computer

By far, parents thought that the advantages to having a home computer outweighed the disadvantages. One of the main advantages cited by nearly all of the parents in some form or another was the gift of convenience: "You know it's like sometimes people go to the library to do something. Instead of going to the library, you can sit right here, like you have the public library around the house. So instead of going and working on it, you stay there and do it." Having to make a special trip to the library or to a friend's or relative's home to use a computer was extremely inconvenient, so much so that many parents simply did not do it.

Other parents said that having a computer in the home made searching for information "easier" and "more relaxed," since one was under no time restrictions. Moreover, at least one parent tied this sense of relaxation and comfort to an increase in searching skills: "When that thing [computer] is there, you have more time to look for [something], and the more you have time to look for it, the better you get at looking for that."

Summer 2006 Parent Focus Groups:
***Advantages of Having a Home Computer* (continued)**

Moreover, parents felt that having a computer in the home motivated their children in a way that obtaining information from a library did not:

> *(Parent) Oh my goodness…he's [child] kind of lazy. He didn't want to go out to the library and do reports, so he was getting bad grades...Like I said, he'd rather get on the computer and look it up… He doesn't want to go to the library and actually go read it, sit down and open up the book. It was easier for him to sit at the computer for three or four hours to do it…Because a lot of times, the Internet has more... there's a lot of information.*

The home computers also motivated children to search for information for recreational purposes (e.g., interests and hobbies). Parents explained that their children researched baseball statistics (e.g., home run records), the solar system, the wealthiest people in the world, even celebrity gossip. Sometimes they would discover obscure or interesting facts in relation to their interests and share them with their parents.

Parents also felt the computers gave their children a sense of confidence, particularly as it related to being comfortable with technology and competitive with classmates ("bridging the gap"). According to parents, having a home computer leveled the playing field. One parent made a connection between having a home computer and a child's sense of self-image:

> *Imagine if you have an assignment. Instead of [thinking someone will be] going to the library, some teachers will just assume, go to the Internet, check this out, this is the website. They don't know whether the kid had the computer at home or anything. And if you [child] are in a classroom and some kids have, you know your friends have access, have a computer and you don't have one, you know what that does to their self image. Some of the kids, they'll feel bad, they will not say that because they can't, but you just know. Whereas if you have one [a computer] at home, you are kind of at par. So you go home, you have a computer, you can type stuff in and do your assignment.*

Parents mentioned several other advantages, alluded elsewhere in this report. These included being able to communicate with others (e.g., family members, friends) as well as communicate with their children. One mother said that working alongside her son on the computer "formed a different bond [for them]…You know other than just sitting down and watching a TV program together or going to a movie together, a different kind." Academic advantages were also cited, particularly as they related to writing reports for school. Parents nodded their heads in agreement when one parent said that "giving the computer to one child does not just affect the child that it is given to—it affects the whole family," to which another parent added, "especially if there are younger kids."

Finally, we asked parents what the primary advantage of having a home computer was *for them.* Their responses were similar to what they noted for their children: entertainment, convenience (e.g., being able to do work at home as opposed to going into the office), communication, and learning to type faster. One parent said the greatest advantage to him is that his child is happy to have a computer: "Because as a parent, the kid is the most important to you, as long as the kid is happy and is doing the right thing, you are happy," to which all parents agreed.

Summer 2006 Parent Focus Groups:
Disadvantages to Having a Home Computer

The most common disadvantage reported by parents was having the phone line tied up for the dial-up connection (one parent had even paid for an additional phone line). Also frequently mentioned was the quality of the computers—parents complained that the machines were slow and often "froze up," especially after installing games ("The computer is old—that's the main thing").

A few parents were concerned that children in general can become "addicted to the computer." One parent, who worked in the schools as a substitute teacher, explained:

> *I have a student, he's on his computer and his mom is like "I don't know what to do." Take the computer out of his home. He doesn't play with anyone. He sits in his house all day long, then he comes to school and he's like this all day long, and then he becomes a behavior problem, because you got to tell him to lift his head up. "Well I'm tired!" "That's not my problem—stay off the computer and go to bed on time." They can get addicted. That's what it is. It becomes a drug. Go to computer anonymous.*

Other disadvantages mentioned by parents included:

- Family and friends outside the home coming over to use the computer and overstaying their welcome,
- Siblings fighting over use of the computer,
- Children "getting lazy" (e.g., not reading books anymore; not going to the library anymore),
- Children not being as social (i.e., isolated with the computer), and
- Personal frustration over parents' own level of skills or knowledge (e.g., "not being able to get through to the website that I want and not knowing if I'm doing it right or even connecting to the right website").

It should be noted that parents' perceptions of the benefits of the SPARC computers remained relatively unchanged over the 2004–05 school year. Thus, parents' overall positive orientation toward having a home PC appears to have been unaffected by the problems they encountered with their SPARC computers.

Treatment parents were also asked to provide examples of how the SPARC computer had benefited their 5th grade child. Almost two-thirds (65 percent) described how having a computer had helped their child with homework (Table 6-8). Other parents described how their SPARC computers had facilitated their child's efforts to locate reading material or remained focused on reading text (7 percent), improved their child's computer skills (6 percent), or improved their child's grades (4 percent). Exhibit 6-2 provides examples of parents' responses to this item. One interesting pattern that emerges from a review of these responses is that 27 percent of treatment parents referenced a specific academic subject when describing school-related benefits—with math being cited most frequently (e.g., "She advanced a lot more in her math," "She can do her homework on math," "It has helped him with his math skills," and "Improved his grades this year—and his math grade improved greatly").

Table 6-8.—Treatment parents' assessment of how the SPARC computer has been *most* helpful to their 5th grader

Assessment	Percent (N=137)
Helped with homework	65
Served as a resource for reading	7
Improved their computer skills	6
Improved their grades	4
Enabled them to look up information	3
Fed their hunger for learning	3
Enabled them to play games	2
Kept them occupied	1
Other	2
No response	2
SPARC computer not working/no longer in household	4

NOTE: Percents may not sum to 100 because of rounding.

SOURCE: eSPARC spring 2005 Post-Intervention Parent Survey.

Exhibit 6-2.—Examples of how treatment parents perceived the SPARC computer had been helpful to their 5th grade child

School and Homework

- It has helped him a lot with his writing skills.
- It helps [name of student] a lot with his homework—he builds, draws, and looks up different websites.
- We do not have to go to the library as often.
- He is more interested in his school work now.
- Able to look up words for spelling.
- It has helped her write her ESOL homework.
- It has helped her do research for her history and science projects for school.
- More interested in doing book reports.

Improved Computer Skills

- The eSPARC computer has helped him learn how to maneuver the computer and learn basic skills.
- Helping him learn about computers and how to look for things without help.
- It has helped her to learn how different parts of the computer are named.

Improved Grades

- The main way the eSPARC computer has helped [name of student] is by getting better grades due to math websites.
- He has improved in all of his grades—he has improved from Cs to Bs.
- Improved his grades this year and his math grades improved greatly.
- Grades came up in reading, writing, research on computer, social studies.

Exhibit 6-2.—Examples of how treatment parents perceived the SPARC computer had been helpful to their 5th grade child–continued

Other

- It has helped him develop his hunger for learning.
- She has a resource for when her curiosity sparks.
- It has helped his typing skills, helped search for information, learned e-mailing.
- Helps her find information she is looking for.
- It has helped him look up information that he is interested in like looking up different animals.
- I couldn't buy the books so [name of student] looked on the computer—it was better.
- It has helped her in keeping her attention—when she has a regular book to read she can't focus, but on the computer she stays focused.
- Keeps her occupied, helps her learn to do stuff like typing and slide shows.
- It kept them occupied—they don't go out so much.

NOTE: Responses reflect notes taken by Westat telephone interviewers—that is, these are not direct quotes and may not reflect verbatim what parents said during the telephone interview.

Finally, treatment students were asked about the extent to which they believed having their SPARC computer had affected their confidence and computer skills. As shown in Table 6-9, almost all treatment students agreed that having the SPARC computer made them feel more confident about the things they could do (90 percent) and improved their computer skills (85 percent). However, only 50 percent agreed with the statement that they liked school more as a result of having the SPARC computer.

Table 6-9.—Percentage of treatment students agreeing with various statements about the impact of having a home computer

Statement	Strongly agree	Kind of agree	Kind of disagree	Strongly disagree
I feel more confident about the things I can do	58%	32%	6%	4%
My computer skills have improved	58	27	9	7
I like school more	25	25	19	30

NOTE: N=137. Percents may not sum to 100 because of rounding.

SOURCE: eSPARC Spring 2005 Post-Intervention Student Survey.

Summary

Study findings suggest that at least some treatment households decreased the frequency with which they used their SPARC computers over time, with 41 percent of treatment student *and* parents reporting that they had made no use of their SPARC computers in the week preceding the follow-up survey. This decreased use of the SPARC computers by students and parents by spring 2005 may be related to a combination of factors—including the initial novelty of having a home computer, which diminished over time, and the degradation of their refurbished computers. It is also conceivable that families decreased their use not because the computers were impaired, but because they came to be perceived as inadequate—that is, parents and students accustomed to faster computers and Internet connections in other locations might have grown impatient with their slower SPARC computers and dial-up connections.

With the exception of the helpline, only a few of the treatment households took advantage of the other services made available through the SPARC intervention. Thus, while SPARC was designed to make a wide range of supplemental educational resources available to participants, the findings presented in this chapter suggest that the average treatment group household only attended an initial training session that focused on setting up and making basic use of the home computers.

Treatment students and parents generally perceived that they had benefited as a result of having gained access to a home computer. Most notably, almost all (88 percent) treatment parents responded to an open-ended item about how their 5th grader benefited from having a home computer with examples of school- or education-related behaviors (e.g., using computers for homework or reading) that had not occurred prior to their participation in SPARC. In addition, most parents agreed with close-ended statements that the SPARC computer had a positive effect in a wide range of areas pertaining to their 5th grade child, including the quality of their schoolwork, their overall confidence in their abilities, and their interest in technology and school. Findings from the focus groups also attest to the positive impact the home computers had on treatment families. Although some families experienced a degree of frustration with their SPARC computer, many considered it an indispensable resource for daily life, education, and recreation.

7. IMPACT OF SPARC ON STUDENTS

Few empirical studies have used rigorous designs to examine the impact of computer use on students. The use of in-classroom random assignment in the SPARC study enabled us to examine whether providing home computers and dial-up Internet access enhances students' engagement and success in school. This chapter assesses the impact of the SPARC intervention on 5th grade study participants for a wide range of educational and social measures—including computer use, computer skills, computer attitudes, interactions with other household members, engagement in school, and academic performance.

Several notes about the presentation of findings in this chapter are in order. First, throughout this chapter, tests of statistical significance (including *t*-tests and chi-square tests) are used to ascertain whether any observed differences between treatment and control group students are statistically significant at the .05 level. Differences that *are* significant at the .05 level suggest that the observed difference between treatment and control group students is a result of the SPARC intervention. Only statistically significant differences are called out in the text.

Second, the tables within this chapter provide findings overall for all study participants, as well as separately for treatment and control group students. The tables also indicate the direction of the mean difference between treatment and control group students where the difference is statistically significant. Specifically, a "+" symbol indicates a difference that favors treatment students, while a "-" symbol indicates a difference that favors control students. Third, results from more complex statistical techniques, including factor analysis, and multivariate regression analysis, are also presented in this chapter. More detailed descriptions of these methodologies are presented in Appendix A.

Fourth, the presentation of findings in this chapter is divided into two broad categories: (1) information that 5th grade study participants and their teachers provided about such intermediate outcomes as computer use, computer skills, computer attitudes, interactions with other household members, and engagement in school; and (2) student achievement data (i.e., grades and assessment scores) provided by the schools that could be used to examine whether the SPARC intervention had an impact on 5th grade study participants' academic performance. To the extent possible, self-reported findings obtained through student surveys are supplemented with independent data from other sources (e.g., teachers' assessments of the extent to which each 5th grade study participant was engaged in schoolwork).

Fifth, results from the case studies are presented in call-out boxes throughout this chapter. The case study results shed additional light on the quantitative findings and help to portray in greater depth the study population and their use of computers. In reviewing these findings, it should be noted that the case study findings reflect the experiences of study participants in a single school and may not be representative of the entire study population. Chapter 3 provides an overview of how these case studies were conducted.

Sixth, comparisons throughout this chapter between treatment and control students are used to assess the extent to which treatment students were affected by the intervention, regardless of whether or not (1) treatment students actually *used* the SPARC home computers, and (2) control students gained

access to a home computer over the course of the 8-month intervention.[48] In order to assess whether the student outcomes changed as a result of these conditions, we adjusted the treatment group by removing the 21 students who reported no use of a home computer in the month before the May 2005 survey was administered. We also removed the 37 "crossover" cases in which control students reported using computers at home to any extent in the last month. Bivariate comparisons of the adjusted treatment and control groups revealed nearly identical patterns to the full study sample, although the effect size estimates increased in some cases (not shown in tables). Given this result, we have concluded that for this intervention and population, there was not a great deal of difference in findings with respect to *access* and *utilization*. As such, all of the findings presented in this chapter refer to the full study sample.

Finally, in reviewing these findings, it is important to keep in mind that the study population was restricted to 5th graders among relatively poor urban families that did not have home computers before the SPARC intervention. As such, any impacts—or lack thereof—should not be viewed as a general indication of what happens when 5th grade students are provided access to a home computer and dial-up Internet access. Nor should the findings in this chapter be used to determine whether 5th graders should be provided access to computers at home. Rather, the findings in this chapter should be viewed as an indication of what can be expected to happen when a passive home technology intervention is made available to one specific population.

Intermediate Student Outcomes

Evaluations of educational technology initiatives frequently focus on student academic performance. However, efforts to increase home access to computers and the Internet can be expected to produce a wide range of intermediate student outcomes—including increased computer use, increased use of computers with parents and siblings, enhanced computer skills, increased engagement in school and learning, and improved student home life and relationships. This section examines the extent to which the combination of services provided through the SPARC intervention had an impact on those intermediate outcomes with treatment students. The findings presented throughout this section rely on three sources: the May 2005 student and parent surveys, the teacher log, and the interviews with 18 students in the York case study school.

Computer Use

All 5th grade study participants had at least some access to computers and the Internet (e.g., at their school) throughout the study, and most reported making use of computers in at least one location. For example, 91 percent of students in the study reported using a computer at school at least once in the previous month (on the May 2005 survey), with 58 percent reporting computer use at school several times in the past week (Table 7-1). It should be noted that we have no way of determining whether this computer use occurred during classroom hours (as part of daily instruction) or after school (as part of an after-school program or self-motivated activity).

[48] As discussed in Chapter 6, the May 2005 student survey found that 41 percent of treatment students had not used their SPARC computers in the previous school week. In addition, as is discussed in this chapter, 23 percent of control students reported on the May 2005 student survey that they had used a home computer at least once in the past month.

Table 7-1.—Extent of study students' use of computers at various locations

Location of computer use	Total (N=309)	Treatment (N=152)	Control (N=157)	T-C	p-value
At school					.87
Not at all	10%	11%	8%		
Once or twice in the last month	12	13	12		
About once a week	21	18	23		
Several times a week	21	21	21		
Almost every day	37	38	36		
At home				+	.00*
Not at all	46	14	77		
Once or twice in the last month	8	11	6		
About once a week	9	13	4		
Several times a week	13	21	6		
Almost every day	24	42	7		
At a public library				+	.04*
Not at all	54	52	57		
Once or twice in the last month	17	13	20		
About once a week	10	11	9		
Several times a week	10	13	8		
Almost every day	9	11	7		
At a relative's home					.46
Not at all	48	48	48		
Once or twice in the last month	16	16	17		
About once a week	15	13	16		
Several times a week	12	11	13		
Almost every day	9	13	6		
At a friend's home					.19
Not at all	62	59	65		
Once or twice in the last month	16	19	14		
About once a week	11	9	12		
Several times a week	5	5	6		
Almost every day	6	9	3		
At an after-school program					.10
Not at all	72	69	75		
Once or twice in the last month	5	5	4		
About once a week	6	5	6		
Several times a week	7	6	8		
Almost every day	11	15	6		

* $p \leq .05$.

NOTE: Percents may not sum to 100 because of rounding.

SOURCE: eSPARC Post-Intervention Student Survey, 2005.

As expected, treatment students reported significantly more frequent use of computers at home than did control students. In May 2005, 63 percent of treatment students reported using a computer at least several times a week at home, compared to 13 percent of control students.[49] Surprisingly, even though treatment students had access to a home computer, they still made more frequent use of computers than their control counterparts at public libraries—24 percent of treatment students reported using public

[49]More surprising is the finding that 23 percent of control group students reported computer use at home in the last month, suggesting that some control group households acquired a computer at some point after random assignment (or else repaired an existing computer that was not in "working" condition in the summer of 2004). However, analyses revealed that *none* of the findings presented in this report changed significantly after excluding the population of control group students who had used computers at home in the last month.

library computers at least several times a week, compared to 15 percent of control students. However, treatment and control students reported roughly equivalent levels of computer use at other locations (e.g., a relative's home, a friend's home, and an after-school program).

These findings reveal that gaining access to a home computer did not diminish treatment students' computer use at other locations. Treatment students were as likely as control students to use computers at relatives' homes, friends' homes, school, and after-school programs. They were even *more* likely than control students to use computers at public libraries, perhaps suggesting that treatment students were seeking faster Internet connections or other software programs not available on their home computers.

Use of computers for school-related purposes. Study participants' overall use of computers and the Internet for school-related purposes was limited, with only about one-third reporting that they had used a computer to type up homework (32 percent) or work on a spreadsheet (36 percent) within the previous month (Table 7-2). However, the majority (64 percent) of students indicated that they had used a computer to find information on the Internet for school at least once or twice in the past month. Most students reported no use of computers for completing a homework assignment in language arts (i.e., reading, writing, or spelling, 71 percent), mathematics (78 percent), social studies (79 percent) or science (83 percent). This finding was the same regardless of whether the students' teachers did or did not report regularly assigning homework that required the use of computers and/or the Internet**.**

Table 7-2.—Frequency of study students' computer use for school-related purposes

School-related use of computers	Total (N=309)	Treatment (N=152)	Control (N=157)	T-C	p-value
Typing up homework for school				+	.00*
Not at all	69%	57%	80%		
Once or twice in the last month	13	19	6		
About once a week	11	14	8		
Several times a week	8	10	6		
Working on a spreadsheet				+	.00*
Not at all	65	51	78		
Once or twice in the last month	16	20	12		
About once a week	9	16	3		
Several times a week	11	14	8		
Finding information on the Internet for school					.27
Not at all	36	31	41		
Once or twice in the last month	24	27	22		
About once a week	20	22	18		
Several times a week	20	20	19		
Doing mathematics homework				+	.00*
Not at all	78	68	87		
Once or twice in the last month	8	12	3		
About once a week	8	11	4		
Several times a week	7	9	6		
Doing science homework				+	.05*
Not at all	83	78	89		
Once or twice in the last month	6	9	4		
About once a week	6	9	4		
Several times a week	4	5	4		

Table 7-2.—Frequency of study students' computer use for school-related purposes—continued

School-related use of computers	Total (N=309)	Treatment (N=152)	Control (N=157)	T-C	p-value
Doing social studies homework				+	.00*
Not at all	79	69	89		
Once or twice in the last month	10	17	4		
About once a week	7	9	4		
Several times a week	4	5	3		
Doing reading, writing, or spelling homework				+	.00*
Not at all	71	59	83		
Once or twice in the last month	11	17	5		
About once a week	10	13	6		
Several times a week	9	11	7		

* $p \leq .05$.

NOTE: Percents may not sum to 100 because of rounding.

SOURCE: eSPARC Post-Intervention Student Survey, 2005.

Home access to a computer and the Internet appeared to influence the extent to which treatment students made use of these tools for school-related purposes. For example, over twice as many treatment students reported using computers for typing up homework (43 percent, compared with 20 percent of control students) or working on a spreadsheet (50 percent, compared with 23 percent of control students) in the previous month (Table 7-2). In addition, treatment students were more likely than control students to use computers for doing homework in mathematics, science, social studies, and language arts—e.g., 41 percent of treatment students reported using computers at least once or twice in the previous month for language arts homework, compared with 18 percent of control students. However, it is worth noting that there were no differences in the extent to which treatment and control group students made use of the Internet for school-related purposes.

Thus, while a modest percentage of study participants were using computers for various school-related purposes, findings indicate that treatment students were using computers and the Internet more frequently for schoolwork than control students. In interpreting these findings, it is important to note that most students were not required by their teachers to use computers for school-related purposes. Specifically, as discussed in Chapter 5, only 27 percent of teachers assigned homework at least once a month that required the use of computer or the Internet. Perhaps seen in this light, it is encouraging that so many treatment students were using computers at all for school-related purposes.

The York Case Study Sample:
How Study Participants Used Computers for School

Treatment and control group students in the York case study school tended to use computers in similar ways for their schoolwork. For example, both groups used computers to type stories or other papers, correct their spelling through word processing, print pictures for reports, and use the Internet to find information. To a lesser degree, students reported using "Homework Helper" to find information and using the computer's calculator for math and learning "times tables."

All students in the York case study school were required to complete a 4th grade multidisciplinary project in order to be promoted to the 5th grade. Since completion of this project required use of the Internet, many students spoke of how they had used the computer the year before to research their self-selected topics (most of which were based on various animals). One girl said that she used the computer to learn "about jaguars—their habitat, that they weigh almost 300 pounds, and have the biggest bite." Another remembered finding information on the Internet for his report on ostriches: "They don't stick their heads in the sand to hide. They do eat sand to help them digest food."

Data from the teacher log provide additional evidence that treatment students' access to a home computer enhanced their ability to meet some classroom requirements. As shown in Table 7-3, most 5th grade students met or exceeded fourth quarter classroom requirements for using multiple sources to prepare written assignments/projects (68 percent), using computers and the Internet to locate and retrieve information (81 percent), and using computers to present information (82 percent). However, treatment students were more likely than their control counterparts to meet or exceed classroom requirements in these three areas. For example, 74 percent of treatment students met their classroom requirement regarding using multiple sources, compared with 61 percent of control students. Treatment students were also more likely to meet their classroom requirement for using computers and/or the Internet to locate and retrieve information (83 percent, compared with 77 percent for control students) and to present information (87 percent, compared with 79 percent for control students).

Table 7-3.—Extent to which study students met fourth quarter classroom requirements for computer-related tasks

Computer-related task	Total	Treatment	Control	T-C	p-value
Use multiple sources—that were relevant, appropriate and current—to prepare written assignments and/or projects				+	.03*
Did not meet	6%	5%	7%		
Partially met	26	21	31		
Met	47	49	44		
Somewhat exceeded	10	11	10		
Greatly exceeded	11	14	7		
Use computers and/or the Internet to locate and retrieve information				+	.05*
Did not meet	3	2	3		
Partially met	17	14	21		
Met	53	53	53		
Somewhat exceeded	15	14	15		
Greatly exceeded	13	16	9		

Table 7-3.—Extent to which study students met fourth quarter classroom requirements for computer-related tasks—continued

Computer-related task	Total	Treatment	Control	T-C	p-value
Use computers to present information—e.g., to type reports or prepare graphics/data				+	.05*
Did not meet	2	2	3		
Partially met	15	12	18		
Met	54	54	55		
Somewhat exceeded	15	16	15		
Greatly exceeded	13	17	9		

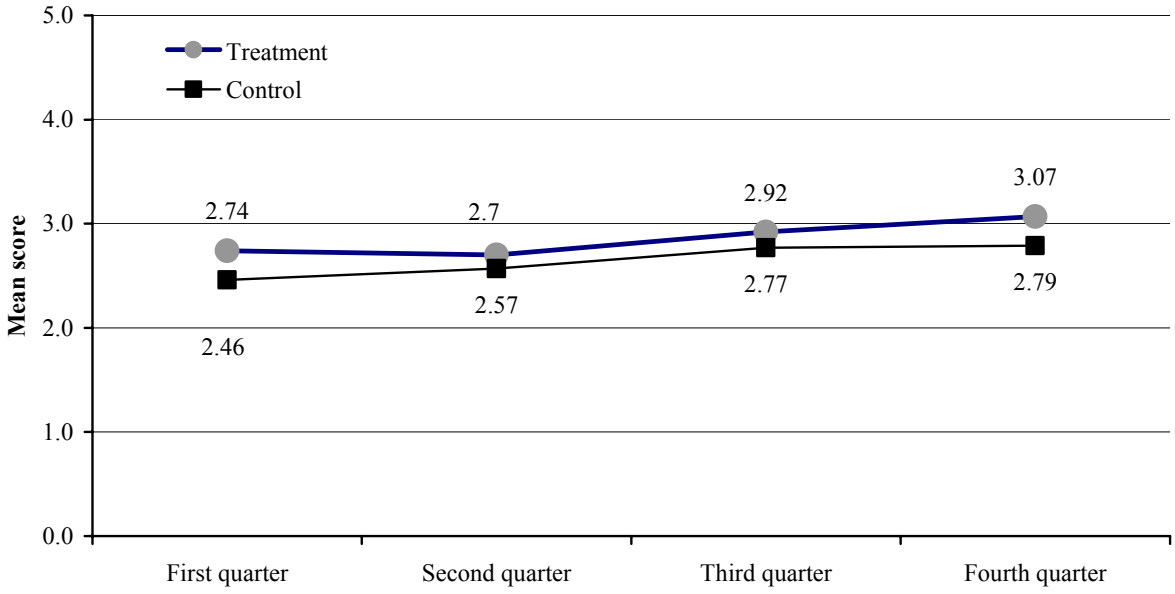
* $p \leq .05$.

NOTE: Percents may not sum to 100 because of rounding.

SOURCE: eSPARC teacher log, fourth quarter, 2005.

It is worth noting that the differences on each of these three items between treatment and control students initially appeared in the first quarter of the school year (about a month after treatment students received their SPARC computers). An analysis of teacher log data across the four grading periods reveals that teachers' perceptions of the difference between treatment and control students' performance on these three measures did not change over time. For example, as shown in Figure 7-1, by the end of the first grading period, treatment students were already more likely to meet the classroom requirement for using multiple sources than their control counterparts. This divergence in how teachers perceived treatment and control students' use of multiple sources was apparent in each of the three succeeding grading periods.

Figure 7-1.—Extent to which study students met the classroom requirement for using multiple sources (that were relevant, appropriate and current) to prepare written assignments and/or projects in each of the four grading periods



NOTE: Extent meeting requirements is presented as a 5-point scale.

SOURCE: eSPARC teacher log, quarterly submissions throughout the 2004–05 school year.

Use of computers for recreational purposes. The most common computer activities for study participants were playing games and listening to or downloading music. In fact, as shown in Table 7-4, half (51 percent) of students reported using computers for playing games several times a week. Fewer study participants reported using computers several times a week to find information on the Internet not for school (21 percent), type up something not for school (19 percent), or send e-mail messages to friends or relatives (17 percent). The least commonly cited activities included instant messaging, downloading software, and going to chat rooms. This is similar to findings from previous studies that suggest that students generally spend most of their time on home computers for such recreational purposes as game-playing and socializing with friends (Attewell et al. 2003; Ba, Tally, and Tsikalas 2002; Giacquinta et al. 1993). In this respect, study participants behaved much as would be expected—i.e., the 5th graders were using computers and the Internet frequently for a wide range of recreational purposes.

Treatment students were more likely than control students to report using computers for each of the recreational activities included in the post-intervention survey. For example, 63 percent of treatment students reported playing games several times a week, and 43 percent reported listening to or downloading music several times in the previous week, compared with 39 percent and 22 percent, respectively, of control group students (Table 7-4). In addition, 25 percent of treatment students reported using a computer to type up something not for school several times in the past week, compared with 13 percent of control students.

Table 7-4.—Frequency of study students' computer use for recreational purposes

Recreational use of computers	Total (N=309)	Treatment (N=157)	Control (N=153)	T-C	p-value
Playing games				+	.00*
Not at all	11	5	16		
Once or twice in the last month	16	12	20		
About once a week	22	20	25		
Several times a week	51	63	39		
Listening to or downloading music				+	.01*
Not at all	42	28	55		
Once or twice in the last month	11	13	10		
About once a week	14	17	12		
Several times a week	32	43	22		
Finding information on the Internet that was NOT for school				+	.00*
Not at all	46	35	56		
Once or twice in the last month	17	15	20		
About once a week	16	19	13		
Several times a week	21	31	11		
Typing up something NOT for school				+	.00*
Not at all	48	35	61		
Once or twice in the last month	16	15	17		
About once a week	17	25	9		
Several times a week	19	25	13		
Sending e-mail messages to friends or relatives				+	.00*
Not at all	65	49	80		
Once or twice in the last month	9	11	7		
About once a week	9	14	5		
Several times a week	17	27	8		

Table 7-4.—Frequency of study students' computer use for recreational purposes—continued

Recreational use of computers	Total (N=309)	Treatment (N=157)	Control (N=153)	T-C	p-value
Talking with a friend using instant messaging				+	.00*
Not at all	72	59	84		
Once or twice in the last month	9	13	5		
About once a week	8	11	5		
Several times a week	12	18	6		
Downloading software from the Internet				+	.00*
Not at all	74	63	85		
Once or twice in the last month	10	13	8		
About once a week	8	11	5		
Several times a week	8	13	3		
Going to a chat room				+	.00*
Not at all	80	72	87		
Once or twice in the last month	6	9	3		
About once a week	7	11	4		
Several times a week	7	9	6		

* $p \leq .05$.

NOTE: Percents may not sum to 100 because of rounding.

SOURCE: eSPARC Post-Intervention Student Survey, 2005.

The York Case Study Sample:
How Study Participants Used Computers for Recreational Purposes

Both treatment and control students were quick to reel off specific names of favorite websites and computer games, including the home websites of Disney, Nickelodeon, the Cartoon Network, and Black Entertainment Television (BET). Frequently cited topics for website searches included Barbie dolls, NASCAR racing, pop music singers, and Pokemon. Treatment group children were more likely to report that Solitaire, Pinball, FreeCell, and Minesweeper were their favorite games, perhaps because they were available on their SPARC computers. Although we asked about games that "didn't have to do with school," control group students were more likely to respond with the names of educational games they had played during class—e.g., Super Science Show, Math Rabbit, Magic School Bus, Reading Rabbit, Mission Comprehension, STAR math games, and Kids Next Door. Other control group students did not know the specific names of the computer games they played but said they used them in the computer lab with their teachers (a "circus" game and "car" game).

Treatment group students generally reported spending more time on their SPARC computers during the weekend than during the week. Typically, that additional time was spent playing games and surfing the Internet. However, in some cases, treatment group students reported spending less time on their SPARC computers on the weekend because other family members (siblings, cousins, parents) were using them. One child lamented, "I'd like to spend more time on there, but my mom is on there for about 4 hours a day using eBAY."

We were also interested in whether access to a home computer affected study participants' engagement in other nonacademic activities. Specifically, we asked children in both treatment and control groups whether they preferred watching television, playing outside, reading, or using the computer "for whatever they wanted." This was one of the few instances in the York case study sample where there were clear differences between the two groups—with eight of the nine control group students indicating that their first preference was computing, while the nine treatment group children responded with varying preferences for television or computers. In addition, the control group children overwhelmingly talked about their desire to play computer games:

The York Case Study Sample:
***How Study Participants Used Computers for Recreational Purposes* (Continued)**

It [computer] has games and other stuff.

TV, you just lay down and flip through the channels. With computers you can play games. It would be cool if you could play duck, duck, goose on the computer.

I'd rather use computers. When I am at my aunt's place, I use her computer all the time to play games.

We also asked students whether they had ever gotten interested in something that "had nothing to do with school because you read about it, saw pictures of it, or starting to play/learn about it on the Internet." Responses from both the treatment and control groups were similar, with most responding that this had not happened to them. A few study participants in both groups explained that they had used the Internet to pursue such existing interests as television shows ("Bugs Bunny" and "Full House—how Mary Kate and Ashley got rich") and products they had seen advertised on television (e.g., video games). However, these students indicated that their use of the Internet had not instigated a new interest. Rather, it allowed them to pursue an existing interest.

Computer Use With Family Members and Other Individuals

Giacquinta et al. (1993) concluded that the "social envelope" around children, meaning the skills and involvement of family members, is critical to making use of computers as learning resources, rather than merely as tools for entertainment. As noted by Attewell (2003), children from lower income households may be at a disadvantage with respect to using computers for educational purposes, because they lack a sufficiently rich social envelope.

As such, one area of interest was whether the SPARC intervention affected the extent to which treatment group students used computers with other individuals. A primary expectation was that providing households with a computer and Internet access would promote greater interaction between 5th grade students and other family members, including parents and older siblings who might be in a position to help 5th graders with computer-related skills, and younger siblings who might be tutored by 5th graders in basic computing tasks.

Data from the post-intervention survey shed some light on the extent to which study participants made use of computers with other family members. As shown in Table 7-5, 55 percent of treatment and control group students reported that they often worked alone on computers. However, only 14 percent reported often working with a parent, and 61 percent reported that they rarely or never worked with a parent on a computer. In addition, few study participants reported often working on a computer with a younger brother or sister (14 percent), an older brother or sister (13 percent), some other adult in the household (10 percent), or a friend (9 percent).

Table 7-5.—Extent to which study students used computers on their own, with other household members, and with friends

People with whom student used computers	Total (N=309)	Treatment (N=157)	Control (N=153)	T-C	Sig
Alone				+	.00*
Not at all	17%	6%	27%		
Hardly ever	6	5	7		
Sometimes	22	20	24		
Often	55	69	42		
With a parent				+	.00*
Not at all	45	25	64		
Hardly ever	16	17	15		
Sometimes	26	37	16		
Often	14	22	6		
With some other adult in the household				+	.00*
Not at all	51	32	70		
Hardly ever	18	23	13		
Sometimes	21	31	12		
Often	10	15	5		
With a *younger* brother or sister				+	.00*
Not at all	55	35	72		
Hardly ever	13	17	10		
Sometimes	18	27	10		
Often	14	21	8		
With an *older* brother or sister				+	.00*
Not at all	52	34	69		
Hardly ever	12	14	11		
Sometimes	23	32	15		
Often	13	21	6		
With a friend					.84
Not at all	52	53	52		
Hardly ever	14	14	14		
Sometimes	25	23	28		
Often	9	11	7		

* $p \leq .05$.

NOTE: Percents may not sum to 100 because of rounding.

SOURCE: eSPARC Post-Intervention Student Survey, 2005.

A comparison of treatment and control group students suggests that the SPARC intervention did, in fact, influence computer use interactions with other household members. Specifically, treatment students were more likely than control students to report frequent computer use with a parent (22 percent, compared with 6 percent for control group students), a younger sibling (21 percent versus 8 percent), an older sibling (21 percent versus 6 percent), and some other adult in the household (15 percent versus 5 percent). In addition, treatment group students were more likely than their control counterparts to report frequent use of a computer on their own. However, there was no difference in the extent to which treatment and control group students reported using computers with their friends.

While the survey data do not reveal how computers were being used jointly, they do indicate that some of the exchange and interaction involved the giving and receiving of computer-related assistance. As shown in Table 7-6, study participants were most likely to seek frequent help in using computers (i.e., several times a week) from their teacher (16 percent) or a parent (13 percent). Conversely, they were most

likely to provide frequent computer-related assistance to a sibling (15 percent) or a parent (12 percent). Students were far more likely to receive help using computers from teachers than to give help.

Table 7-6.—Extent to which study students received and gave help in using computers

People who helped/received help	Total (N=309)	Treatment (N=152)	Control (N=157)	T-C	p-value
Extent to which students received help using computers from various people in the last month					
From a parent				+	.00*
Not at all	56%	38%	73%		
Once or twice in the last month	15	14	16		
About once a week	17	26	8		
Several times a week	13	22	4		
From a teacher				-	.04*
Not at all	36	42	30		
Once or twice in the last month	18	19	18		
About once a week	30	24	36		
Several times a week	16	15	17		
From a brother or sister				+	.00*
Not at all	67	52	82		
Once or twice in the last month	15	19	11		
About once a week	6	10	2		
Several times a week	12	18	6		
From a friend					.28
Not at all	68	66	70		
Once or twice in the last month	12	13	11		
About once a week	14	12	16		
Several times a week	6	9	3		
Extent to which students gave help using computers to various people in the last month					
To a parent				+	.00*
Not at all	53%	31%	73%		
Once or twice in the last month	15	17	14		
About once a week	20	33	8		
Several times a week	12	19	6		
To a teacher					.32
Not at all	82	79	85		
Once or twice in the last month	7	10	5		
About once a week	5	4	7		
Several times a week	5	7	4		
To a brother or sister				+	.00*
Not at all	53	38	67		
Once or twice in the last month	16	16	16		
About once a week	17	22	12		
Several times a week	15	24	6		

Table 7-6.—Extent to which study students received and gave help in using computers—continued

People who helped/received help	Total (N=309)	Treatment (N=152)	Control (N=157)	T-C	p-value
To a friend					.65
Not at all	55	59	51		
Once or twice in the last month	20	15	25		
About once a week	15	15	15		
Several times a week	10	11	9		

* $p \leq .05$.

NOTE: Percents may not sum to 100 because of rounding.

SOURCE: SPARC Post-Intervention Student Survey, 2005.

It appears that the SPARC intervention influenced the extent to which treatment group students sought and provided computer assistance. Treatment students were more likely than control students to receive frequent computer help from parents (22 percent versus 4 percent) and siblings (18 percent versus 6 percent). However, they were *less* likely than control students to seek out help from teachers (15 percent versus 17 percent), suggesting relatively greater competence (or at least confidence) in using computers. Treatment students were also more likely than control students to report providing frequent computer assistance to parents (19 percent versus 6 percent) and siblings (24 percent versus 6 percent).

These findings suggest that the SPARC computers affected family interactions in some treatment households, and that some of the treatment families considered computer and Internet use as a joint venture for learning and recreational purposes. Further, case study findings point to considerable efforts among treatment students and their parents and siblings to understand computers, what they have to offer, and how they work.

Computer Skills

Given the prevalence of computers in our society, the development of basic computer skills has become necessary for success in both school and the workplace. At a minimum, adequate computer skills are necessary to fully benefit from the resources made available by computers and the Internet.

Participating students were asked to assess various aspects of their computer and Internet skills. Overall, the 5th grade study participants reported that they had achieved a level of competence in most basic computer skills. For example, most reported needing no help in saving a computer file (77 percent), erasing or deleting a computer file (66 percent), printing a computer file (61 percent), and renaming a computer file (60 percent) files (Table 7-7). At least two-fifths indicated that they could cut and paste a computer file (49 percent), download graphics or pictures from the Internet (47 percent), send and read e-mail (42 percent) and find computer files (41 percent) with no help. Fewer students professed the ability to bookmark web pages (34 percent) and attach files to an e-mail (21 percent) without help.

Table 7-7.—Study students' self-assessment of their basic computer skills

Basic computer skill	Total (N=309)	Treatment (N=152)	Control (N=157)	T-C	p-value
Save a file.					.06
Not sure	7%	6%	8%		
Never did it before	6	5	8		
Need help to do it	10	7	12		
Can do it without help	77	83	72		
Erase or delete a file.				+	.01*
Not sure	11	7	14		
Never did it before	10	8	11		
Need help to do it	14	11	17		
Can do it without help	66	74	58		
Print a file					.67
Not sure	12	11	13		
Never did it before	13	14	12		
Need help to do it	14	11	16		
Can do it without help	61	64	59		
Rename a file				+	.00*
Not sure	11	7	15		
Never did it before	11	11	12		
Need help to do it	18	12	24		
Can do it without help	60	71	50		
Cut and paste				+	.03*
Not sure	15	11	19		
Never did it before	14	14	14		
Need help to do it	21	19	23		
Can do it without help	49	55	44		
Download graphics or pictures from the Internet					.96
Not sure	15	18	13		
Never did it before	14	11	16		
Need help to do it	24	21	27		
Can do it without help	47	50	45		
Send and read e-mail				+	.00*
Not sure	16	12	20		
Never did it before	25	16	34		
Need help to do it	16	14	19		
Can do it without help	42	57	28		
Find a file.					.49
Not sure	17	19	16		
Never did it before	15	12	18		
Need help to do it	27	23	31		
Can do it without help	41	46	36		
Make a bookmark for a web page					.16
Not sure	19	18	20		
Never did it before	22	21	23		
Need help to do it	26	22	29		
Can do it without help	34	40	28		

Table 7-7.—Study students' self-assessment of their basic computer skills—continued

Basic computer skill	Total (N=309)	Treatment (N=152)	Control (N=157)	T-C	p-value
Attach a file to an e-mail message					.25
Not sure	22	25	20		
Never did it before	34	26	41		
Need help to do it	24	24	24		
Can do it without help	21	26	16		

* $p \leq .05$.

NOTE: Percents may not sum to 100 because of rounding.

SOURCE: eSPARC Post-Intervention Student Survey, 2005.

As shown in Table 7-8, most students also reported that they could independently type up a story on a computer (81 percent) and search for information on the Internet (78 percent). However, fewer students indicated that they needed no help in working on a spreadsheet (44 percent).

Table 7-8.—Study students' self-assessment of their advanced computer skills

Advanced computer skill	Total (N=309)	Treatment (N=152)	Control (N=157)	T-C	p-value
Type a story or report on a computer					.31
Not sure	7%	5%	8%		
Never did it before	5	5	5		
Need help to do it	8	7	8		
Can do it without help	81	83	79		
Search for information on the Internet					.46
Not sure	7	6	8		
Never did it before	6	5	7		
Need help to do it	9	9	8		
Can do it without help	78	79	77		
Work on a spreadsheet				+	.00*
Not sure	17	18	17		
Never did it before	20	12	27		
Need help to do it	20	13	26		
Can do it without help	44	58	30		

* $p \leq .05$.

NOTE: Percents may not sum to 100 because of rounding.

SOURCE: eSPARC Post-Intervention Student Survey, 2005.

The York Case Study Sample:
Study Participants' Computer Skills

A performance-based task, administered to the 18 students in the York case study sample, provided us a unique opportunity to observe study participants' computing skills relative to a set of academically oriented activities. The purpose was to have students demonstrate their proficiency for a range of computer-related tasks, including basic word processing and searching for and filtering relevant information for homework assignments.

With respect to specific computing skills, most of the study participants were slow typists who used improper hand-keyboard placement (i.e., typing with one hand or finger). Most knew how to increase font size, but did not know how to bookmark sites. Treatment students were more likely to know how to cut and paste text (some had recently attended a voluntary SPARC training that addressed this skill), as well as how to e-mail (though children in neither group seemed to know how to attach a file to an e-mail message).

All but one participant named a favorite website (e.g., Barbie.com, Groovygirls.com, NASCAR.com). On those sites that children were able to access at the school, they demonstrated how they used the Internet to play games, read about their favorite athletes or celebrities, or draw and color pictures.

On the portion of the performance assessment that focused on study participants' strategies for finding information on a school-related topic, all nine of the treatment students and seven of the nine control students indicated they would use the Internet to search for research information. However, a higher number of treatment students (seven, compared with three control students) said that the Internet was their *first choice* for information. When asked to demonstrate how they would search for information on the Internet, seven students in each group used the Google search engine and roughly equal numbers (seven treatment and eight control students) used the *same* strategy to search for information, i.e., typing a key word into the Google search field. While two of the treatment students and one control student revised their key word one or more times to facilitate more targeted results, most never revisited their search queries once they entered a key word.

Students also used different strategies for deciding which websites to explore in greater detail. Equal numbers of treatment and control group students (four) chose a site simply based on a title that piqued their interest or curiosity; students also chose sites based on their descriptions (eight treatment and four control children). A few students in both groups appeared to put little thought into website selection—that is, they entered a site simply because it was the first one listed, or they clicked at random. When asked whether selected sites were useful for the task at hand, students in both groups gave similar justifications. Specifically, some cited the abundance or relevance of information and facts on the site, while others emphasized the inclusion of interesting pictures or other graphics.

Finally, students were asked to use the Internet to find answers to various questions about a research topic. Once again, the methods used by both groups of students were roughly similar. Some students remained on the home page of their selected website and read closely for answers, while others hit the forward arrow to read subsequent web pages and click on embedded links. A third group of students visited more than one website to find the necessary information (using the same initial search phrase). Five in each group were able to find the necessary information. However, when asked to find a picture to accompany their research, treatment and control students used different methods. Specifically, six of the nine treatment students used a picture from a website they had already visited; while six control students went back to Google, clicked on "images," and typed in a key word on the assigned topic (students in the York case study sample were shown how to use Google Images last year for their multidisciplinary projects).

An analysis of individual survey items reveals a higher (self-reported) level of skills among treatment students for four of the 10 basic—and one of the three advanced—computer tasks included on the post-intervention survey. As shown in Table 7-7, treatment students were more likely to report being able to do a variety of basic computer functions without help, including erasing or deleting a file (74 percent, compared with 58 percent for control students), renaming a file (71 percent versus 50 percent), cutting and pasting text (55 versus 44 percent), and sending and reading e-mail (57 percent versus 28 percent). While treatment students were more likely to report needing no help in working on a spreadsheet (58 percent, compared with 30 percent for control group students), there were no differences for such other advanced computer skills as typing a story or report and searching the Internet for information (Table 7-8).

These findings suggest that the intervention contributed to a strengthening of computer skills on the part of treatment students, at least with respect to skills in using common tools. However, survey and case study findings suggest that treatment students' web literacy was not significantly enhanced by the intervention.

Attitudes and Perceptions About Computers

Previous research suggests that learning technologies are appealing to young adults, and educators have long tried to harness the enthusiasm generated by computers to enhance student interest in learning (Becker 2002). As expected, study participants' views and attitudes about computers were generally very positive. In fact, students appeared to hold computers in very high esteem, with 85 percent strongly disagreeing with the statement "I think computers are boring," 74 percent strongly agreeing that they would rather write school reports using a computer than write them by hand, and 65 percent strongly agreeing that computers made learning more interesting (Table 7-9). In addition, students believed that the use of computers enhanced their ability to perform school-related activities, with 69 percent strongly agreeing that their writing was better when they used computers, 51 percent strongly agreeing that they understood some things better when using a computer, and 44 percent strongly agreeing that they worked harder at assignments when using a computer. However, almost half of the students (46 percent) agreed to some extent that they often get frustrated using computers. Despite some level of frustration, students seemed confident in their abilities, with 73 percent strongly agreeing that they were "good at using computers and the Internet."

Table 7-9.—Study students' attitudes and perceptions about using computers

Statement about computers	Total (N=309)	Treatment (N=157)	Control (N=153)	T-C	p-value
I'm good at using computers and the Internet					.87
Strongly disagree	1%	1%	1%		
Kind of disagree	3	3	3		
Kind of agree	23	22	24		
Strongly agree	73	74	72		
I often get frustrated when using computers					.41
Strongly disagree	36	34	37		
Kind of disagree	18	16	20		
Kind of agree	30	33	28		
Strongly agree	16	16	15		

Table 7-9.—Study students' attitudes and perceptions about using computers—continued

Statement about computers	Total (N=309)	Treatment (N=157)	Control (N=153)	T-C	p-value
I understand some things better when I use a computer					.08
Strongly disagree	7	11	2		
Kind of disagree	8	7	10		
Kind of agree	34	32	36		
Strongly agree	51	50	53		
Using a computer makes learning more interesting for me				-	.01*
Strongly disagree	6	10	3		
Kind of disagree	5	7	3		
Kind of agree	23	22	25		
Strongly agree	65	62	69		
I would rather write school reports using a computer than write them by hand					.12
Strongly disagree	8	11	5		
Kind of disagree	3	3	3		
Kind of agree	15	16	15		
Strongly agree	74	71	77		
My writing is better when I use a computer than when I write by hand				-	.01*
Strongly disagree	8	11	4		
Kind of disagree	6	8	4		
Kind of agree	18	18	18		
Strongly agree	69	63	74		
I work harder at my assignments when using a computer					.14
Strongly disagree	11	15	8		
Kind of disagree	11	11	12		
Kind of agree	33	33	33		
Strongly agree	44	41	47		
I am better than most of the kids in my class at using computers					.24
Strongly disagree	14	14	14		
Kind of disagree	23	21	25		
Kind of agree	34	30	37		
Strongly agree	29	35	24		
I think computers are boring				+	.04*
Strongly disagree	85	81	90		
Kind of disagree	5	5	4		
Kind of agree	5	6	4		
Strongly agree	6	7	4		

* $p \leq .05$.

NOTE: Percents may not sum to 100 because of rounding.

SOURCE: eSPARC Post-Intervention Student Survey, 2005.

Most study participants held very positive views about computers. Nonetheless, there were some interesting differences between treatment and control students. In fact, participants' responses to four survey items about student attitudes suggest that SPARC had a *negative* impact on treatment students' perceptions. Specifically, treatment students were less likely to agree that using computers makes learning

more interesting for them (84 percent, compared with 94 percent for control students), and that their writing is better when using a computer than when writing by hand (81 percent versus 92 percent). They were also *less* likely to disagree with the statement that computers are boring (86 percent versus 94 percent).

While the intervention appears to have had a negative impact on treatment students' attitudes about computers, it should be noted that both study groups held computers in very high esteem overall. There are several potential explanations for the slightly less positive views about computers held by the treatment students. One possibility is that the provision of the SPARC computer presented treatment group students with more opportunities for frustration, either because their skills were not sufficiently developed or their parents had imposed some academic requirements on their computer use at home, or because of issues associated with the slow Internet speed or reduced functionality of some SPARC computers.[50] Conversely, it is possible that control group students based their strong positive orientation on more wishful thinking, having yet to experience more fully the real-world challenges and frustrations of computer use.

The York Case Study Sample:
Study Participants' Views and Attitudes About Computers

Six of the nine control students and two of the nine treatment students in the York case study sample indicated that computers made learning more interesting for them. Control students gave various and rather pragmatic reasons for their preference for computers:

> *If you get something wrong, you don't get yelled at by the teacher—you just do it over again.*
>
> *You can find pictures on there [to print out]; you can't cut pictures out of encyclopedias.*
>
> *When you are working on computers, nobody breathes down your neck.*
>
> *We had a test on the computer after reading Harry Potter, and you knew right then if you got the answer right or wrong.*

Two treatment students offered similarly pragmatic responses about how computers facilitated learning:

> *"When the teacher is talking, you should be listening, but it's easy to start thinking about other things [which is not the case with computers]."*
>
> *"Because when you have to do an assignment and you have to draw pictures, instead I'll go on the Internet and print it out…you can also write faster on a computer."*

Students provided pragmatic responses to questions about whether they understood things better on a computer. In fact, their responses had more to do with the utility of computers and their own attention spans than their relative understandings with and without computers. For example, students talked about "zoning out" when a teacher was talking and paying better attention when they could "see it and hear about it." Students in both groups also alluded to the convenient nature of computers:

> *You can click on something on the Internet to save it, but you can't save books. [Plus] with books you have to read a lot to find the information you want, so it takes a long time.*
>
> *You can paint using the computer even though I can't paint in real life. You can erase it, but you can't in real life….a computer's eraser won't go away or ruin the paper.*

[50] A test of association revealed a significant correlation between treatment student reports of frequent problems with their home computers and reports of frustration with computers.

The York Case Study Sample:
Study Participants' Views and Attitudes About Computers **(continued)**

However, one control group student appeared to link computer use with increased understanding, commenting that "you remember pictures better on the computer since they are neat looking and you talk about them more. You don't really talk about pictures when you see them in books." One student in the control group disagreed on the survey that computers enhanced understanding and explained in the interview that he understands things better when he "can touch them."

Both groups of children preferred to use a computer to write reports than to write them by hand, and their reasons were, again, largely pragmatic. They spoke of disliking their "sloppy" handwriting, taking too long to write by hand ("your hand gets tired"), and not having to "mess up your paper with eraser marks." They also liked the fact that the computer checked their spelling for them.

On the other hand, equal numbers of treatment and control group children found computers to be "frustrating," though their reasons for this sentiment differed. Treatment group children spoke exclusively of technical problems, and though we did not ask them specifically about their SPARC home computers, they referenced them nonetheless. Specifically, they were frustrated when Internet pop-ups appeared ("things keep popping up and I 'X' them out but they keep popping up"), when the computers were "slow," and when the "computer froze a lot." Control group children, on the other hand, had a mixed bag of frustrations, some dealing with technical problems and others not. They spoke of "not understanding big words on the computer," not knowing how to get on the Internet, and "typing in where I want to go, but it won't let me" (presumably referring to the Internet filters on the school computers that blocked certain websites).

Nearly all of the children in the treatment group reported on the surveys that their SPARC computers made them more confident about the things they could do. While some were unable to articulate why they felt this way, others referenced new skills and resources: "When you're on the Internet and you're searching for things, you know where to look because you've done it a few times. Like when I do research on the panda, I get to look it up on the computer on a CD-ROM that my grandpa got me."

Engagement in School and Learning

Engagement in school and learning is considered by many educators and researchers to be a key stepping stone to academic achievement (McGarity and Butts 1984; Sandholtz, Ringstaff, and Dwyer 1994). Student engagement may be broadly defined as a positive orientation toward school and learning, as displayed in conduct, affective reactions or feelings of identification or belonging at school, and cognitive or psychological investment in learning (Fredricks, Blumenfeld, and Paris 2004).

Several studies have indicated that students who use computers at home may become more engaged in school and learning (Becker 2000b; Sandholtz, Ringstaff, and Dwyer 1994; Tsikalas 2004). Tsikalas (2004) found that greater home computer use was associated with several measures of student engagement, especially among lower performing students. Tsikalas, Gross, and Stock (2002) concluded that home computing may lead to positive engagement outcomes especially among lower income students, since it may be used to satisfy basic psychological needs such as autonomy, belonging/relatedness, and competence, all of which enhance student engagement and are more difficult for lower income students to satisfy in other environments.

Findings from previous sections suggest that the SPARC program had a significant impact on treatment students' computer use, computer skills, and views about computers. Specifically, treatment students were making greater use of computers for school-related and recreational purposes, their computer skills were somewhat strengthened, and their views about computers, while very positive, were somewhat tempered by their experiences. This section triangulates evidence from multiple sources to address whether these changes ultimately contributed to enhanced engagement in learning and schoolwork. For the purposes of this study, we focused on two broad types of student engagement—emotional (i.e., attitudes and feelings about school), and behavioral (i.e., ways in which students act to promote success and learning in school).

Attitudes about school and core subject areas. Study participants displayed very positive attitudes about school and core subject areas. For example, most students agreed (kind of or strongly) that they always worked hard and tried their best at school (97 percent), that most things they learned in school were useful (90 percent) and that their teacher cared about them (88 percent) (Table 7-10). Students also had favorable opinions about core subject areas. For example, about three-quarters of students said that they usually or always found mathematics (75 percent) and science (73 percent) interesting (Table 7-11). A comparison of opinions across treatment and control students revealed no statistically significant differences for any of the four core subject areas.

Table 7-10.—Study students' attitudes and perceptions about school

Statement about school	Total (N=309)	Treatment (N=152)	Control (N=157)	T-C	p-value
I always work hard and try my best at school					.35
Strongly disagree	1%	1%	0%		
Kind of disagree	2	3	2		
Kind of agree	29	28	30		
Strongly agree	68	68	68		
Most things we learn in school are useful				-	.01*
Strongly disagree	4	6	3		
Kind of disagree	6	7	4		
Kind of agree	38	41	36		
Strongly agree	52	46	57		
I would rather be at school than stay at home					.26
Strongly disagree	16	19	13		
Kind of disagree	16	17	15		
Kind of agree	34	31	37		
Strongly agree	35	34	35		
My teacher cares about me				-	.02*
Strongly disagree	7	9	4		
Kind of disagree	6	5	8		
Kind of agree	21	27	15		
Strongly agree	67	59	74		
My schoolwork is too hard					.44
Strongly disagree	41	44	38		
Kind of disagree	26	25	27		
Kind of agree	23	21	24		
Strongly agree	10	10	10		

* $p \leq .05$.

NOTE: Percents may not sum to 100 because of rounding.

SOURCE: eSPARC Post-Intervention Student Survey, 2005.

Table 7-11.—Study students' assessment of whether core subject areas are interesting

Subject area	Total (N=309)	Treatment (N=152)	Control (N=157)	T-C	p-value
Mathematics					.47
Always boring	9%	10%	9%		
Usually boring	16	15	17		
Usually interesting	38	34	41		
Always interesting	37	41	33		
Science					.3
Always boring	14	17	10		
Usually boring	13	12	15		
Usually interesting	33	31	35		
Always interesting	40	39	40		
Social studies					.96
Always boring	24	25	23		
Usually boring	25	23	27		
Usually interesting	31	31	31		
Always interesting	20	21	20		
Reading, writing, and spelling					.88
Always boring	20	21	19		
Usually boring	19	19	20		
Usually interesting	35	31	38		
Always interesting	27	29	24		

NOTE: There were no statistically significant differences between treatment and control for any variables in this table. Percents may not sum to 100 because of rounding.

SOURCE: eSPARC Post-Intervention Student Survey, 2005.

School-related behaviors. Another way in which students reveal their level of engagement in school is through their actions and behaviors. Students demonstrate how much they like school and learning in the effort they expend to do the work expected of them and to portray themselves as good students. Findings on a range of items from the student survey and teacher log help to portray student engagement in terms of school-related behaviors.

As shown in Table 7-12, a majority of study participants reported that they often came to class with their homework completed (65 percent) and often paid attention in class (59 percent). Smaller proportions of students indicated that they often read books on their own that were not for school (30 percent), asked for help from teachers about schoolwork (29 percent), asked questions in class (25 percent), and shared information found on the Internet with teachers or classmates (23 percent). In addition, 24 percent of students reported spending 1 or more hours per school night on homework, while 61 percent reported spending less than an hour per school night on homework and 15 percent reporting no time spent at all on homework (Table 7-13). Almost half (46 percent) spent no time on homework on weekends.

Table 7-12.—Study students' self-assessment of their level of engagement in school-related behaviors

School-related behavior	Total (N=309)	Treatment (N=152)	Control (N=157)	T-C	p-value
Ask questions in class					.25
Never	3%	3%	2%		
Hardly ever	9	9	8		
Sometimes	64	65	64		
Often	25	23	27		
Pay attention in class					.98
Never	1	1	1		
Hardly ever	3	5	2		
Sometimes	37	33	41		
Often	59	61	57		
Come to class with homework completed					.21
Never	1	0	1		
Hardly ever	6	3	8		
Sometimes	29	31	26		
Often	65	66	64		
Read books that were NOT for school					.11
Never	12	13	12		
Hardly ever	18	23	13		
Sometimes	40	36	44		
Often	30	28	32		
Ask for help from teacher about schoolwork					.25
Never	6	7	5		
Hardly ever	18	19	17		
Sometimes	47	48	47		
Often	29	26	32		
Share information found on the Internet with teachers or classmates					.95
Never	25	24	27		
Hardly ever	17	21	12		
Sometimes	35	31	39		
Often	23	24	22		

NOTE: There were no statistically significant differences between treatment and control for any variables in this table. Percents may not sum to 100 because of rounding.

SOURCE: eSPARC Post-Intervention Student Survey, 2005.

Table 7-13.—Number of hours study students reported spending on homework

Time on homework	Total (N=309)	Treatment (N=152)	Control (N=157)	T-C	p-value
Time spent on homework each day during the week outside of school					.39
Not at all	15%	16%	14%		
Less than 1 hour	61	60	62		
1 to 2 hours	18	20	17		
More than 2 hours	6	3	8		
Time spent on homework on weekends					.96
Not at all	46	44	48		
Less than 1 hour	32	35	30		
1 to 2 hours	18	19	17		
More than 2 hours	4	2	5		

NOTE: There were no statistically significant differences between treatment and control for any variables in this table. Percents may not sum to 100 because of rounding.

SOURCE: eSPARC Post-Intervention Student Survey, 2005.

A comparison of individual survey items did not uncover any statistically significant differences between treatment and control students for any of these engagement items. With respect to homework, treatment and control students reported about the same amount of time on homework during the week and on weekends. Further, responses from the parent post-intervention survey confirm that there was no difference in time spent on homework between treatment and control students (Table 7-14).[51]

Table 7-14.—Parents' assessment of the amount of time their 5th grade child spent doing homework

Time on homework	Total (N=291)	Treatment (N=137)	Control (N=154)	T-C	p-value
Number of days each week spent on homework outside of school					.92
Not at all	1%	2%	1%		
1 to 2 days a week	9	10	8		
3 to 4 days a week	44	41	47		
5 or more days a week	46	47	44		
Average number of minutes spent on homework on an average school night	86	84	87		.42

NOTE: There were no statistically significant differences between treatment and control for any variables in this table.

SOURCE: SPARC Post-Intervention Parent Survey, 2005.

Observations from the teacher log provide another perspective on whether study students were engaged in selected school-related activities. As shown in Table 7-15, teachers reported that most treatment and control participants met or exceeded the class requirement for completing homework (69 percent) and coming to school prepared to participate on a daily basis (72 percent). In addition, the majority of study participants sometimes or frequently performed the following tasks: work to the best of their ability on a daily basis (88 percent), editing and revising assignments (82 percent), ask informed or insightful questions in class (76 percent), show persistence when confronted with difficult problems (75 percent), and share verbal or printed information relevant to class topics (72 percent).

[51] Although parents reported slightly higher estimates of their children's time spent on homework, there were no differences between the estimates of treatment and control group parents.

Table 7-15.—Teacher assessment of study students' engagement in their school work

Teacher assessment	Total	Treatment	Control	T-C	p-value
Extent to which students met classroom requirements in the past grading period for various classroom behaviors					
Complete homework accurately and thoroughly—rather than just try to get by				+	.07
Did not meet	8%	7%	10%		
Partially met	22	21	23		
Met	45	43	47		
Somewhat exceeded	13	15	11		
Greatly exceeded	11	14	9		
Come to school prepared to participate in class on a daily basis				+	.13
Did not meet	6	5	7		
Partially met	22	20	24		
Met	43	42	45		
Somewhat exceeded	12	14	10		
Greatly exceeded	17	19	15		
Frequency with which students engaged in classroom activities					
Edit and revise assignments—e.g., to correct spelling or mathematics errors, improve sentences, include additional details					.07
Never	1	1	2		
Rarely	17	15	20		
Sometimes	42	41	42		
Frequently	40	43	36		
Share verbal or printed information with you or with others that is relevant to a classroom topic (s)					.67
Never	12	14	9		
Rarely	17	13	21		
Sometimes	39	37	41		
Frequently	33	37	29		
Ask informed or insightful questions in class					.15
Never	5	4	7		
Rarely	18	20	17		
Sometimes	45	40	51		
Frequently	31	37	26		
Show persistence when confronted with difficult problems					.48
Never	4	6	3		
Rarely	22	19	24		
Sometimes	37	33	40		
Frequently	38	42	33		
Work to the best of his/her ability on a daily basis					.41
Never	1	1	1		
Rarely	11	9	13		
Sometimes	38	39	38		
Frequently	50	52	49		

NOTE: There were no statistically significant differences between treatment and control for any variables in this table. Percents may not sum to 100 because of rounding.

SOURCE: SPARC teacher log, fourth quarter, 2005.

Once again, there were no statistically significant differences between the treatment and control students for any of the classroom behavior items on the teacher log. Nor were any statistically significant differences found with respect to student attendance (see Table 7-21).[52] Treatment and control students missed about the same number of days of school during the school year, and so the intervention neither positively nor negatively influenced school attendance. Taken together with the findings from the student and parent data, this lack of differences suggests that the SPARC intervention did not have a significant impact on student engagement in school.

Student Home Life and Relationships

Obtaining a household computer for the first time may have effects on patterns of behavior and relationships within a family. Attewell, Suazo-Garcia, and Battle (2003) found that home computer use for less than 8 hours per week was not associated with less time spent on reading or outdoor activities, but that heavy home computer use (8 or more hours per week) was associated with much less time spent on reading and outdoor activities. They also found that children who used home computers for less than 8 hours per week had significantly higher self-esteem than children without home computers. Similarly, Tsikalas (2004) found that home computing increased students' self-confidence and improved relationships with their families, especially among lower performing students.

Findings from the post-intervention survey reveal that the SPARC intervention had no measurable impact on various aspects of treatment students' home lives, including television viewing, self-esteem, and relationships with parents and siblings. In general, most study participants watched television almost every day (77 percent) during the last month, and 55 percent said that they played outside with friends almost every day (Table 7-16). Fewer students reported reading for fun almost every day (17 percent). It is interesting to note that while many treatment students reported using their home computers on a daily basis, this use does not appear to have diminished the amount of time they spent on other activities—there were no statistically significant differences between treatment and control students with respect to the amount of time spent watching television, reading for fun, or playing outside with friends.

Table 7-16.—Extent to which study students engaged in recreational activities

Recreational activity	Total (N=309)	Treatment (N=152)	Control (N=157)	T-C	p-value
Watching television					.47
Not at all	3%	1%	4%		
Once or twice in the last month	1	1	1		
About once a week	7	8	6		
Several times a week	12	12	14		
Almost every day	77	78	76		
Playing outside with friends					.88
Not at all	10	11	9		
Once or twice in the last month	3	3	4		
About once a week	11	10	12		
Several times a week	21	20	22		
Almost every day	55	57	54		

[52]For analysis of attendance data, we removed three outliers (two from the treatment group and one from the control group) who had more than 30 days of absence.

Table 7-16.—Extent to which study students engaged in recreational activities—continued

Recreational activity	Total (N=309)	Treatment (N=152)	Control (N=157)	T-C	p-value
Reading for fun					.71
Not at all	28	29	27		
Once or twice in the last month	12	14	10		
About once a week	19	17	21		
Several times a week	24	22	25		
Almost every day	17	18	16		

NOTE: There were no statistically significant differences between treatment and control for any variables in this table. Percents may not sum to 100 because of rounding.

SOURCE: eSPARC Post-Intervention Student Survey, 2005.

As shown in Table 7-17, most study participants expressed strong agreement with the statements "I have a lot of confidence in myself" and "I get along well with my parents" (75 percent and 73 percent, respectively). Fewer students (31 percent) strongly agreed with the statement "I get along well with my brother(s) and sister(s)." Once again, the intervention had no impact on treatment group students for any of these items—treatment students were equally as likely as control students to agree that they had a lot of confidence in themselves and that they got along well with parents and siblings.

Table 7-17.—Study students' assessment of family relationships and their own self-confidence

Statement	Total (N=309)	Treatment (N=152)	Control (N=157)	T-C	p-value
I get along well with my brother(s) and sister(s).					.59
Strongly disagree	11%	11%	10%		
Kind of disagree	19	24	14		
Kind of agree	40	30	48		
Strongly agree	31	35	28		
I get along well with my parent(s).					.08
Strongly disagree	0	1	0		
Kind of disagree	5	5	5		
Kind of agree	23	26	19		
Strongly agree	73	69	76		
I have a lot of confidence in myself.					.15
Strongly disagree	1	2	1		
Kind of disagree	4	6	2		
Kind of agree	20	19	21		
Strongly agree	75	73	76		

NOTE: There were no statistically significant differences between treatment and control for any variables in this table. Percents may not sum to 100 because of rounding.

SOURCE: eSPARC Post-Intervention Student Survey, 2005.

Bivariate Comparison of Intermediate Student Outcome Factors

The analysis of individual survey items, described above, provides an overview of how students responded to individual aspects (e.g., ability to use computers for word processing) of a broader outcome (e.g., overall computer skills). While the analyses of differences between treatment and control students at the individual item level were informative, it was difficult to examine them simultaneously to make reliable assessments about the overall impact of the SPARC intervention. Factor analysis was therefore used to examine the relationship between individual items from the May 2005 student survey under the following larger constructs: frequency of computer use for school, frequency of computer use for

recreation, computer skills, computer attitudes, student interest in schoolwork, and student participation in schoolwork.[53] Similar procedures were used to examine items on the teacher log that were used to obtain teachers' perspectives on student engagement in schoolwork.

As is shown in Table 7-18, treatment students were more likely than their control counterparts to report using computers for recreational and school-related purposes. They were also more likely to report stronger computer skills than control students. Interestingly, control students exhibited slightly more positive attitudes about computers than treatment students. However, the SPARC intervention did not affect students' interest or participation in their schoolwork, as reported by both study students and their 5th grade teachers. Taken together, these findings suggest that providing home access to computers and the Internet resulted in an increase in treatment students' use of computers for school and recreational purposes, as well as an increase in their assessment of their own computer skills, but these gains did not ultimately cause students to become more interested or involved in their schoolwork.

Table 7-18.—Comparison of factor outcomes for treatment and control students

Outcome		Treatment	Control	T-C	Effect size
Student factors *(from individual items in the May 2005 student survey)*	Frequency of computer use for school	3.26	2.74	0.53**	0.54
	Frequency of computer use for recreation	3.35	2.66	0.70**	0.74
	Computer skills	3.14	2.86	0.29**	0.28
	Computer attitudes	2.87	3.13	-0.26*	-0.26
	Interest in schoolwork	3.01	2.99	0.02	0.02
	Participation in schoolwork	2.97	3.03	-0.06	-0.06
Teacher log factor	Teacher perspective on student engagement in schoolwork	3.09	2.91	0.18	0.18

*p≤0.05, ** p≤0.01.

NOTE: Student factor scores reflect means on a 5-point scale.

SOURCE: eSPARC Post-Intervention Student Survey, 2005 and teacher log, fourth quarter 2005.

Findings from the Multivariate Analysis of Intermediate Student Outcomes

The bivariate findings presented in the preceding sections provide evidence that the SPARC intervention had a positive impact on such intermediate student outcomes as overall frequency of computer use (for both academic and recreational purposes) and computer skills. However, factors other than study status (such as student characteristics, teachers' use of learning technologies in the classroom) have the potential to influence these outcomes. We therefore used a combination of multivariate techniques to develop a statistical model that "explained" these intermediate student outcomes as the joint result of exposure to the SPARC intervention and other preexisting conditions. The purpose was to determine whether the SPARC intervention had a statistically significant impact on a range of intermediate student outcomes.

Findings from a series of multiple regression analyses that included a range of other potential explanatory variables corroborated the bivariate results (Table 7-19). Thus, even when controlling for a combination of student (e.g., gender, race/ethnicity, participation in special education programs) and household (e.g., primary language spoken at home, educational attainment of parents) characteristics, the

[53]See Chapter 3 and Appendix A for a detailed description of the process used to develop factors, as well as the individual items that were considered and eventually included in the factors that appear in this chapter.

SPARC intervention had a positive and significant impact on student computer use (for both academic and recreational purposes) and computer skills. Further, multivariate findings confirm that it had a negative and significant impact on student computer attitudes (e.g., feelings about computers, beliefs about the value of computers for learning and writing), and no significant effect on student engagement.

Besides confirming the bivariate results, the regression model revealed that factors apart from the SPARC intervention were influencing the attainment of several intermediate student outcomes. For example, as shown in Table 7-19, everything else being equal, parental educational attainment was positively associated with students' computer skills, while student participation in special education programs was positively related to student computer use (for both school-related and recreational purposes). In addition, controlling for other factors (including study status), female study students were more likely than their male counterparts to report stronger computer skills, possess more positive attitudes about computers, and be more engaged in schoolwork. However, neither student race/ethnicity, language spoken at home, nor participation in free or reduced-price lunch was associated (positively or negatively) with any of the intermediate student outcomes.

Finally, we introduced interaction terms to the multiple regression analyses to examine whether any of the relationships described in the preceding paragraph increased or decreased the likelihood that the SPARC intervention had a differentiated impact on any of the intermediate outcomes for individual subgroups of students. For example, given the finding that student participation in a special education program was positively related to student computer use (when controlling for study status and other variables), we were interested in whether treatment students who were enrolled in a special education program were more or less likely than their control group counterparts to demonstrate gains across a range of intermediate student outcomes—including use of computers for academic and recreational purposes, computer skills, attitudes regarding computers, and engagement in schoolwork. However, none of the factors that we examined served to reinforce or diminish the impact of SPARC (Table 7-20). Thus, findings from the multiple regression analyses suggest that there were no conditions under which the SPARC intervention was more or less likely to produce the range of desired intermediate student outcomes that were examined.

Findings on Student Achievement

As discussed in Chapter 2, the lack of rigorous research based on strong methodological grounds has led to a dearth of evidence linking home computer use and student achievement. In addition, the extent to which home computer use influences student achievement depends on a wide array of external conditions, including whether learning technologies are integrated into the classroom curriculum, whether teachers have received training designed to help them integrate learning technologies into the classroom curriculum, the number and nature of computer-related homework assignments that students receive, the amount of computer and Internet-related training provided to students, and the level of parental involvement. Even when all of these conditions are satisfied, the types of skills acquired via computer and Internet use are often not measured by school grades or standardized tests (Becker and Lovitts 2002; Rockman et al. 2003; Quellmalz and Zalles 2002).

Table 7-19.—Multiple regression analysis of intermediate outcomes, controlling for student demographic conditions

Demographic	Computer use		Computer skill		Computer attitudes		Student engagement		Parental involvement	
	B (SE)	Beta	B (SE)	Beta	B (SE)	Beta	B (SE)	Beta	B (SE)	Beta
Intercept	2.32** (0.28)	--	2.67** (0.30)	--	3.21** (0.30)	--	3.44** (0.32)	--	2.66** (0.32)	--
Study status: treatment	0.75** (0.11)	0.37	0.32** (0.11)	0.16	-0.27* (0.12)	-0.13	-0.02 (0.12)	-0.01	-0.05 (0.13)	-0.02
Parents educational attainment	0.05 (0.07)	0.04	0.18* (0.07)	0.15	0.06 (0.07)	0.05	0.02 (0.07)	0.02	0.19* (0.08)	0.15
Student gender: male	-0.02 (0.11)	-0.01	-0.23* (0.12)	-0.11	-0.35** (0.12)	-0.18	-0.44** (0.12)	-0.22	0.03 (0.13)	0.01
Student participation in special ed	0.30* (0.13)	0.13	-0.20 (0.14)	-0.08	-0.11(0.14)	-0.04	-0.26 (0.14)	-0.11	0.11 (0.16)	0.05
Student participation in free or reduced-price lunch	0.03 (0.21)	0.01	-0.13 (0.22)	-0.04	0.14 (0.22)	0.04	-0.20 (0.24)	-0.05	0.01 (0.24)	0.00
Student race/ethnicity: white	-0.23 (0.18)	-0.07	-0.13 (0.19)	-0.04	0.07 (0.19)	0.02	0.19 (0.19)	0.06	0.02 (0.21)	0.01
Non-English lang spoken at home	0.18 (0.13)	0.08	0.15 (0.14)	0.06	-0.17 (0.14)	-0.07	-0.05 (0.14)	-0.02	-0.06 (0.16)	-0.02

* $p \leq 0.05$, ** $p \leq 0.01$

SOURCE: eSPARC Post-Intervention Student Survey, 2005, Post-Intervention Parent Survey, 2005, and Household Recruitment Survey 2004.

Table 7-20.—Moderator effects of SPARC on intermediate student outcomes

Variable	Student computer use for school-related purposes	Student computer use for recreational purposes	Student computer skills	Student computer attitudes	Student interest in schoolwork	Student participation in schoolwork	Teacher perspective on student engagement
Overall[1]							
Student race/ethnicity: White							POS
Student race/ethnicity: African American		POS					NEG
Student race/ethnicity: Hispanic/Latino		NEG					
Student gender: Female			NEG	NEG	NEG	NEG	NEG
Educational attainment of parent			POS				
Student participation in a special education program	POS		NEG				
Primary language spoken at home: English		POS					
Student participation in a gifted/honors program							POS
Household composition							
Parent employment status							
Household income							
Student computer skills	POS	POS					
Parental involvement—child's homework							
Parental involvement—communication about school/interests							
Parent computer skills							
Parental interaction with child on computer			POS				
Parental interaction with child on Internet for school-related purposes							
Parental interaction with child on Internet for non-school-related purposes							
Parental interaction with child on computer	POS	POS	POS		POS		
Classroom computer requirements							
Teacher computer attitudes					POS		POS

[1]In cells with a "POS," the variable had a positive effect on a particular intermediate student outcome at the .05 level. In cells with a "NEG," the variable had a negative effect on a particular intermediate student outcome at the .05 level. In blank cells, the variable did not have an effect on a particular intermediate student outcome at the .05 level.

SOURCE: eSPARC Post-Intervention Student Survey, 2005, Post-Intervention Parent Survey, 2005, teacher log, fourth quarter 2005, and Household Recruitment Survey, 2004.

Although SPARC represented an out-of-school intervention, the study was designed to assess whether the provision of home computer and dial-up Internet access would have any impact on student achievement. Given the findings discussed in the previous section, there was also an interest in whether the positive impact of the SPARC intervention on students' computer use and skills resulted in any tangible gains in other aspects of student learning. For the purpose of the study, student achievement was defined as grades in four core academic subjects (i.e., reading, mathematics, science, and social studies) and the 5th grade Pennsylvania System of School Assessment (PSSA) scores in reading and mathematics.[54] As was the case with the intermediate student outcomes, we used both bivariate and multivariate analyses to examine the impact of the SPARC intervention on student achievement.

Grades

Our first level of analysis involved a simple comparison of fourth quarter item-level grades (in the original scales) for each of the four participating school districts. The results of these district-specific analyses uncovered only one statistically significant difference at the .05 level between treatment and control students: in York, control students scored higher than treatment students on one specific aspect of social studies (i.e., describing the basic principles of economics in social studies) (see tables in Appendix B). Given that the analysis of all other item-level grades revealed no differences between the two groups, we must assume that this specific difference is due to chance.

Our second level of analysis was designed to standardize the idiosyncratic format used to score and report grades across the four study districts. (See Chapter 3 and Appendix A for a discussion of the process used to standardized report card data across the four study districts and 22 study schools.) As shown in Table 7-21, there were no significant differences between treatment and control students in the rescaled grades for any of the four core subject areas.

Table 7-21.—Fourth quarter rescaled grades in core subject areas for study students

Subject area and attendance	Total (N=283)	Treatment (N=140)	Control (N=143)	T-C	p-value
Reading/language arts	2.30	2.29	2.31		.77
Science	2.53	2.55	2.51		.62
Social studies	2.42	2.44	2.40		.59
Mathematics	2.23	2.26	2.19		.41
Number of days absent from school	8.58	9.24	7.92		.14

NOTE: There were no statistically significant differences between treatment and control for any of the variables in the table.

Standardized Achievement Test Scores in Mathematics and Reading

Bivariate findings. The PSSA results show that a slight majority of all study participants (53 percent) performed at or above basic level in reading, and 70 percent performing at or above basic level in mathematics (Table 7-22).[55] Comparison of overall PSSA scale scores revealed no difference between treatment and control students for both reading and mathematics (Table 7-23). In addition, an analysis of

[54]As discussed in Chapter 3, another option would have been to develop or make use of an existing assessment designed to assess the use and application of technology skills. However, available funding precluded the development and/or administration of such an assessment on the 354 students who participated in the study. The case study, conducted in one York school and discussed throughout this chapter, was designed to address at least some of the shortcomings of relying primarily on grades and PSSA scores to assess the impact of SPARC on student achievement.

[55]These percentages are well below the state averages (83 percent for reading and 92 percent for math) (not shown in tables).

scores for each subcomponent of the reading and mathematics assessments uncovered no statistically significant differences (Table 7-24). Taken together, these findings suggests that exposure to the SPARC intervention had no impact on study participants' performance on the PSSA.

Table 7-22.—Performance levels for PSSA exams in reading and mathematics for study students

PSSA subject	Advanced	Proficient	Basic	Below Basic
Reading				
Total	5%	23%	25%	47%
Treatment	4	23	25	48
Control	5	23	25	47
Mathematics				
Total	22	21	27	30
Treatment	20	23	27	30
Control	24	19	28	29

NOTE: There were no statistically significant differences between treatment and control for any of the variables in the table.

Table 7-23.—Overall PSSA scores in reading and mathematics for study students

PSSA subject	Total (N=314)	Treatment (N=159)	Control (N=155)	T-C	p-value
Reading	1,149	1,142	1,158		.53
Mathematics	1,295	1,291	1,303		.64

NOTE: There were no statistically significant differences between treatment and control for any of the variables in the table.

Table 7-24.—Comparisons of PSSA subcomponent scores (raw score)

PSSA subject and subcomponent	Total (N=314)	Treatment (N=159)	Control (N=155)	T-C	p-value
Reading					
Comprehension & Reading Skills (0- 38)	20.17	19.99	20.37		.60
Interpretation & Analysis of Fiction & Nonfiction (0-14)	7.56	7.53	7.60		.80
Mathematics					
Numbers & Operations (0-29)	17.32	17.21	17.45		.66
Measurement (0-9)	4.82	4.91	4.74		.59
Geometry (0-9)	5.64	5.67	5.62		.95
Algebraic Concepts (0-10)	6.09	5.93	6.25		.21
Data Analysis & Probability (0-9)	5.72	5.54	5.90		.17

NOTE: There were no statistically significant differences between treatment and control for any of the variables in the table.

Multivariate findings. Recognizing the nesting structure of the school environment (i.e., students are nested within classes and schools), we used a hierarchical linear modeling (HLM) to compare the performance of treatment and control students. Most of the variables included in the multivariate analyses relied on such preexisting conditions as household characteristics or student demographic information. In addition, a limited number of endogenous variables (i.e., variables that could conceivably be influenced by the intervention itself) were also included in the model to allow for analysis of a limited number of

factors that would otherwise not be possible.[56] The statistical models with only preexisting conditions and with endogenous variables were examined separately.

Findings from the HLM model with only demographic predictors were consistent with the bivariate findings with respect to treatment and control comparisons. Specifically, as shown in Table 7-25, exposure to the SPARC intervention was not a significant predictor of either student grades or PSSA scores in mathematics and reading (controlling for a variety of factors at both the student and classroom levels).[57]

While no classroom-level variables were predictors of any achievement outcomes, the HLM results indicate that several student-level variables were significant predictors of grades and PSSA scores. For example, White students had higher grades in science and higher reading scores on the PSSA than students from other racial/ethnic groups. When controlling for other factors, girls had higher grades in social studies than did boys. In addition, study participants who were in special education programs lagged behind other students for grades in reading, mathematics, and science, as well as in PSSA scores in mathematics and reading. Other factors (e.g., participation in free or reduced-price lunch, language spoken at home) were not found to be significant predictors of student achievement. As shown in Table 7-26, when several endogenous variables were introduced into the model, three additional findings emerged that are worth noting. First, student computer skills were found to be positively related to student grades in reading and science, as well as with PSSA mathematics scores. Second, students with more positive attitudes about computers were more likely to perform better in mathematics as measured by both grades and PSSA scores. Finally, student engagement in school was found to be a significant predictor for *all* achievement measures. Surprisingly, parental involvement was not related to student achievement outcomes, and was even *negatively* associated with PSSA mathematics scores. While the finding regarding parental involvement is intriguing, its explanation is beyond the scope of the current study.

[56]Under optimal conditions, data on these variables (e.g., student engagement, parental involvement) would have been collected prior to the SPARC intervention. However, as discussed in Chapter 3, the need to distribute the SPARC computers to treatment households as soon after random assignment as possible precluded us from obtaining these baseline data.

[57]As shown in Table 7-21, the only exception was that the number of student absences from school was significantly related to exposure to the SPARC intervention in the regression model (that is, controlling for other factors, treatment students were absent from school more often than control students), whereas the bivariate comparison revealed no difference between treatment and control students.

Table 7-25.—HLM model with demographic predictors (only) to examine student achievement outcomes

Predictor	Grades								PSSA scores			
	Reading		Math		Science		Social studies		Math_scale		Reading_scale	
	Coeff	SE	Coeff	SE	Coeff	SE	Coeff	SE	Coeff	SE	Coeff	SE
Student-level predictors												
Intercept	2.307**	0.117	2.086**	0.191	2.500**	0.232	2.370**	0.218	1376.435**	63.490	1177.083**	57.191
Study status: treatment	-0.054	0.063	0.019	0.100	0.041	0.066	0.079	0.079	-1.563	23.532	-11.176	17.737
Pre(subject)	0.549**	0.081	0.420**	0.066	0.214**	0.071	0.262**	0.066	105.056**	16.954	102.488**	25.387
Parent ed attainment	-0.004	0.041	-0.080	0.053	-0.029	0.056	0.032	0.063	15.332	13.136	25.860*	11.957
Student gender: male	-0.160	0.084	0.008	0.087	-0.085	0.064	-.0.130*	0.060	21.977	13.407	3.576	18.859
Student in special ed	-0.379**	0.086	-0.249*	0.100	-0.421*	0.192	-0.351	0.182	-88.672**	23.447	-131.852**	34.911
Student in FRL	0.053	0.093	0.179	0.172	0.085	0.225	0.038	0.182	-71.335	45.733	-4.883	52.445
Student race: white	0.122	0.081	-0.141	0.160	0.223*	0.089	0.181	0.009	46.579	45.804	104.586**	35.312
Non-Eng home lang	0.155*	0.067	0.026	0.099	0.117	0.071	0.140	0.748	-25.903	28.947	-3.778	25.072
Classroom-level predictors												
Comp requirements	0.083	0.060	-0.009	0.053	0.030	0.054			-3.462	18.701	10.078	19.614
Teacher experience	-0.003	0.004	0.001	0.007	0.001	0.005	--		0.091	1.462	0.915	2.542
Teacher education	-0.025	0.054	0.017	0.062	0.049	0.068			16.178	23.824	7.464	23.120
School level (variance components from unconditional model)												
	Original variance	**Percent available**			**Original variance**	**Percent available**	**Original variance**	**Percent available**	**Original variance**	**Percent available**		
Student level	0.341	77.3%		--	0.307	68.2%	0.389	71.0%	33114.657	62.2%		--
Classroom level	0.045	10.2			0.063	14.0	--	--	8179.969	15.4		
School level	0.055	12.5			0.080	17.8	0.159	29.0	11901.884	22.4		
School level (variance components from conditional model)												
	Available variance	**Percent available**			**Available variance**	**Percent available**	**Available variance**	**Percent available**	**Available variance**	**Percent available**		
Student level	0.169	78.2%			0.269	87.1%	0.339	85.8%	21058.835	48.1%		
Classroom level	0.039	18.1			0.040	12.9	--	--	8189.947	18.7		
School level	0.008	3.7			0.000	0.0	0.056	14.2	14491.927	33.1		
	Residual variance	**Variance explained**		--	**Residual variance**	**Variance explained**	**Residual variance**	**Variance explained**	**Residual variance**	**Variance explained**		--
Student level	0.169	50.40%			0.269	12.40%	0.339	12.90%	21058.835	36.40%		
Classroom level	0.039	13.3			0.04	36.5	--	--	8189.947	-0.1		
School level	0.008	85.5			0	100	0.056	64.8	14491.927	-21.8		

*<0.05, ** <0.01.

SOURCE: eSPARC Post-Intervention Student Survey, 2005, Post-Intervention Parent Survey, 2005, and Household Recruitment Survey 2004.

Table 7-26.—HLM model with demographic and intervening predictors to examine student achievement outcomes

Predictor	Grades								PSSA scores			
	Reading		Math		Science		Social studies		Math_scale		Reading_scale	
	Coeff	SE	Coeff	SE	Coeff	SE	Coeff	SE	Coeff	SE	Coeff	SE
Student-level predictors												
Intercept.....	2.201**	0.140	1.980**	0.239	2.533**	0.243	2.389**	0.254	1411.739**	50.701	1244.817**	52.352
Study status: treatment	-0.026	0.060	0.066	0.094	0.064	0.090	-0.044	0.091	14.458	23.444	-11.217	27.421
Pre(subject)	0.518**	0.090	0.339**	0.073	0.126*	0.059	0.170*	0.067	88.242**	16.341	86.330**	27.692
Parent ed attainment....	-0.005	0.047	-0.069	0.060	-0.059	0.057	0.024	0.067	15.395	14.134	24.423	14.254
Student gender: male...	-0.150	0.103	0.009	0.102	-0.075	0.086	-0.051	0.069	65.011**	14.177	15.941	22.800
Student in special ed ...	-0.307**	0.080	-0.248*	0.106	-0.296*	0.115	-0.324	0.181	-47.708	25.246	-109.089**	38.929
Student in FRL	0.115	0.090	0.311	0.227	0.046	0.205	0.018	0.230	-115.095**	40.271	-74.698	48.691
Student race: white.....	0.115	0.088	-0.076	0.182	0.225	0.170	0.157	0.118	9.202	36.416	73.800	43.284
Non-Eng home lang	0.176**	0.063	-0.018	0.088	0.084	0.108	0.205*	0.087	-50.227	28.037	-4.407	25.089
Student comp skill.....	0.071	0.036	0.071	0.056	0.164**	0.048	0.112	0.062	24.965*	11.287	17.944	10.989
Student comp attitudes	0.013	0.028	0.141*	0.055	-0.037	0.052	0.015	0.035	24.164*	10.567	10.542	12.588
Student comp use	-0.041	0.037	0.016	0.059	-0.058	0.052	0.088	0.071	-7.051	14.092	-1.634	13.415
Student engagement....	0.128**	0.034	0.143**	0.042	0.168**	0.049	0.123*	0.059	53.861**	7.715	34.989**	12.020
Parental involvement ..	-0.044	0.022	-0.023	0.049	-0.008	0.044	-0.035	0.042	-22.892*	10.012	-8.664	11.420
Classroom-level predictors												
Computer requirement	0.051	0.065	-0.037	0.057	0.004	0.059			-8.896	15.487	7.744	16.847
Teacher experience	-0.007*	0.003	0.001	0.006	0.002	0.008			1.491	1.942	0.087	2.607
Teacher education	0.008	0.036	0.021	0.064	-0.000	0.083			-4.506	22.692	0.200	25.922
School level (variance components from unconditional model)												
	Original variance	**Percent available**			**Original variance**	**Percent available**	**Original variance**	**Percent available**	**Original variance**	**Percent available**		
Student level.....	0.341	77.3%		--	0.307	68.2%	0.389	71.0%	33114.657	62.2%		--
Classroom level.....	0.045	10.2			0.063	14.0	--	--	8179.969	15.4		
School level.....	0.055	12.5			0.080	17.8	0.159	29.0	11901.884	22.4		
School level (variance components from conditional model)												
	Available variance	**Percent available**			**Available variance**	**Percent available**	**Available variance**	**Percent available**	**Available variance**	**Percent available**		
Student level.....	0.143	75.7%			0.212	72.9%	0.310	83.8%	16063.459	40.2%		
Classroom level.....	0.046	24.3			0.057	19.6	--	--	9966.236	24.9		
School level.....	0.000	0.0			0.022	7.6	0.060	16.2	13959.461	34.9		
	Residual variance	**Variance explained**		--	**Residual variance**	**Variance explained**	**Residual variance**	**Variance explained**	**Residual variance**	**Variance explained**		--
Student level.....	0.143	58.1			0.212	30.9	0.31	20.3	16063.459	51.5		
Classroom level.....	0.046	-2.2			0.057	9.5	--	--	9966.236	-21.8		
School level.....	0	100			0.022	72.5	0.06	62.3	13959.461	-17.3		

* <0.05, ** <0.01.

SOURCE: eSPARC Post-Intervention Student Survey, 2005, Post-Intervention Parent Survey, 2005, and Household Recruitment Survey 2004.

Finally, we introduced the interaction term to the model to examine whether any of the relationships described in the preceding paragraph increased or decreased the likelihood that the SPARC intervention had a differentiated impact on PSSA scores for individual subgroups of students. Once again, the purpose was to explore whether the SPARC intervention had a moderator effect on some of the intervening variables that could eventually influence student achievement. However, no statistically significant impacts for either the reading (Table 7-27a) or mathematics (Table 7-27b) PSSA assessments were uncovered for any of the following variables that were included as interaction terms in the HLM model: (1) student computer use, (2) student engagement, (3) student participation in a special education program, (4) parental involvement, (5) student gender, (6) student race/ethnicity, and (7) teacher classroom use of computers. Taken together, these findings suggest that there were no treatment subgroups that scored higher or lower on the PSSA as a result of their participation in SPARC.[58]

Table 7-27a.—Moderator effects of SPARC on PSSA reading scores

Subgroup/moderator	Slope coefficient predicting PSSA reading score for control group	Slope coefficient predicting PSSA reading score for treatment group	Difference in impact between control and treatment group
Student use of computers	19.49	-7.62	-27.11
Parental involvement with 5th grader	-33.28	0.25	33.53
Student participation in special education	-129.72*	-93.94	35.78
Student gender: male	-35.51	59.11	94.62
Student race/ethnicity: white	97.97	84.09	-13.88
Student engagement	20.92	48.52	27.60
Teachers' computer requirements	-13.37	12.91	26.28

* $p \leq .05$.

SOURCE: eSPARC Post-Intervention Student Survey, 2005, Post-Intervention Parent Survey, 2005, Teacher Survey, May 2005, and Household Recruitment Survey, 2004.

Table 7-27b.—Moderator effects of SPARC on PSSA mathematics scores

Subgroup/moderator	Slope coefficient prediction PSSA math score for control group	Slope coefficient prediction PSSA math score for treatment group	Difference in impact between control and treatment group
Student use of computers	-16.02	18.53	34.55
Parental involvement with 5th grader	-43.35	-16.38	26.97
Student participation in special education	-69.02	-12.40	56.62
Student gender	37.82	83.21	45.39
Student race/ethnicity	-12.18	65.63	77.81
Student engagement	42.27*	63.55*	21.28
Teachers' computer requirement	-14.49	7.5	21.99

* $p \leq .05$.

SOURCE: eSPARC Post-Intervention Student Survey, 2005, Post-Intervention Parent Survey, 2005, Teacher Survey, May 2005, and Household Recruitment Survey, 2004.

[58] Although only findings that were statistically significant at the .05 level are called out in the text, one trend, which was not statistically significant at the .05 level, is worth noting. Specifically, there was a negative relationship between the frequency of student computer use and PSSA math scores among control group students, while a positive relationship was observed among treatment-group students. That is, PSSA math scores for control students declined, on average, 16 points as their computer use increased by one unit; PSSA math scores for treatment students rose, on average, 19 points as their computer use increased by one unit. However, this difference of 35 points was not statistically significant at the .05 level.

There are several potential explanations for the lack of impact on student achievement. First, and perhaps most importantly, the SPARC intervention lacked an academic component that directly linked the home computer to any aspect of study participants' schoolwork. As a result, treatment students may not have viewed the SPARC computers as an educational tool that could be applied to their classroom lessons or homework. Indeed, qualitative evidence from the case study and focus groups suggest that treatment students primarily viewed their home computers as devices for amusement. Viewed in this light, the SPARC computers were not sufficiently tied to schoolwork to expect any significant changes in students' academic performance.

Second, few treatment students took advantage of the voluntary training in basic computer skills that was made available through the SPARC intervention. It is therefore likely that some treatment students lacked the basic skills needed to maximize the educational potential of their home computers. Equally important, they may have lacked a full appreciation of how the computers could be applied to their schoolwork. As such, their educational use of the SPARC computers appears to have been limited to typing up reports (e.g., to take advantage of formatting and spell check tools) and occasionally using the Internet to look up basic information about a subject. Third, significant student achievement outcomes were unlikely simply due to the short period of the intervention.

Finally, grades and PSSA scores may not be the best way to measure the types of changes that would be expected to occur as a result of a home-based technology initiative. Thus, the fact that the intervention did not have a significant impact on students' standardized test scores is not surprising, since such tests do not generally measure the kinds of changes in learning that can result from technology use geared toward developing specific skills or knowledge (Becker and Lovitts 2002; Rockman et al. 2003; Quellmalz and Zalles 2002).

Summary

The study findings suggest that the SPARC intervention had a significant impact on treatment student computer use for school-related and recreational purposes, as well as on student computer skills and views about computers. In addition, qualitative evidence provided throughout this chapter (and in Chapter 6) suggests that many of the students who received an SPARC computer benefited in ways that are difficult to quantify. As such, the study provides evidence that even "passive" home computer interventions can boost students' use of technology for school-related purposes, as well as strengthen their computer skills.

The intervention as designed did not have a significant effect on student engagement in school or on student achievement as measured by grades and standardized assessment scores. It is impossible to determine whether an impact would have occurred with a stronger and longer intervention. However, one can conclude from these findings that short-term home computer interventions that lack an educational component are unlikely to enhance student engagement and achievement (at least among 5th grade students from low-income households).

8. IMPACT OF SPARC ON PARENTS

While the home computers provided to treatment families were intended for use by participating 5th grade students, other family members were encouraged to use them as well. Such shared usage had the potential to create a dynamic environment in which individuals within households share their enthusiasm and encourage each other's developing understanding of computers and the Internet. It also has the potential to increase parental involvement in their children's education both inside the home (e.g., taking on a greater role in checking that homework has been completed or helping with assignments) and at school (e.g., attending parent-teacher conferences or an academic event such as a science fair). Finally, the provision of a home computer can potentially help parents advance educationally or professionally as they gain increased exposure to a set of tools that are commonly found in the workplace.

This chapter focuses on the extent to which the SPARC intervention affected treatment parents in a wide range of areas, including increased use of computers, the attainment of new computer skills, attitudes about computers, and academic and social involvement with their children.[59] As in the previous chapter, tests of statistical significance (including *t*-tests and chi-square tests) were employed to determine whether any observed differences between treatment and control group students were statistically significant at the .05 level. The tables presented in this chapter show results overall for all parents and by study status (treatment versus control). Tables indicate the direction as well as the statistical significance of the mean difference between treatment and control groups.

Computer Use

Most respondent parents[60] (88 percent) reported that they had used computers at one location or another in the last month (Table 8-1). While treatment and control parents did not differ significantly in whether or not they had used a computer at any location (90 percent and 87 percent, respectively), there were differences with respect to *where* they used computers. Most notably and not surprisingly, treatment parents were far more likely than control parents to have used computers at home in the last month (76 percent versus 12 percent).[61]

Although most control parents did not have home computer access, there is evidence that they sought out computers in alternative locations. Control parents were significantly more likely than treatment parents to report having used computers in the last month at a public library (29 percent versus

[59]As in Chapter 7, the comparisons between treatment and control groups provided throughout this chapter addressed the question of the impact of home *access* to computers and the Internet rather than actual *utilization*. To determine the impact of home use of computers and the Internet on parents, we adjusted the treatment group by removing "no use" cases (44 parents) that had not used computers at home in the month before the post-intervention survey was administered in May 2005. Similarly, we removed "crossover" cases from the control group (36 parents) who reported using computers at home in that last month. However, bivariate comparisons of the adjusted treatment and control groups revealed identical patterns, although the effect sizes increased in some cases. Thus, we may conclude that the impact findings of the SPARC intervention on parents were the same from both access and use perspectives.

[60]While some items on the post-intervention parent survey obtained information about both parents (if more than one parent lived in the household), others were only designed to obtain information from the respondent parent. Throughout this chapter, the term "respondent parent" refers to those survey items that reflect only the opinions or status of the parent who responded to the Westat survey.

[61]The finding that 12 percent of control group parents reported computer use at home in the last month (on the May 2005 parent survey) suggests that some control group households acquired a computer at some point after random assignment (or else repaired an existing computer that was not in working condition in the summer of 2004). However, analyses revealed that *none* of the findings presented in this report changed significantly after excluding the population of control group parents who used computers at home in the last month.

11 percent), community or recreation center (13 percent versus 2 percent), and other location (29 percent versus 10 percent).

Table 8-1.—Extent to which respondent parent used computers at various locations

Location of computer use	Total (N=291)	Treatment (N=137)	Control (N=154)	T-C	p-value
Any location	88%	90%	87%		.47
Home	43	76	12	+	.00*
Work	43	41	46		.43
Public library	21	11	29	-	.00*
School or university	18	19	17		.75
Community or recreation center	7	2	13	-	.00*
Some other location	20	10	29	-	.00*

* $p \leq .05$.

SOURCE: eSPARC Post-Intervention Parent Survey, 2005.

Less than half of study parents (43 percent) used computers at work in the last month, with no significant difference between treatment and control parents. Employed parents from both study groups were equally likely to report in May 2005 that they were using computers at work for the same number of days each week. However, treatment parents were significantly more likely to report that they were using computers at work for more than 2 hours each day (69 percent, compared with 43 percent for control parents) (Table 8-2). It is worth noting that treatment and control parents reported spending similar amounts of time on computers at work in fall 2004. This increase in the number of hours of computer use at work by treatment parents is likely the result of the SPARC intervention (Figure 8-1). One possibility is that home access to a computer and the Internet increased their familiarity with technology, which ultimately led to greater use of computers in the workplace.

Table 8-2.—Extent to which respondent parent used computers at work

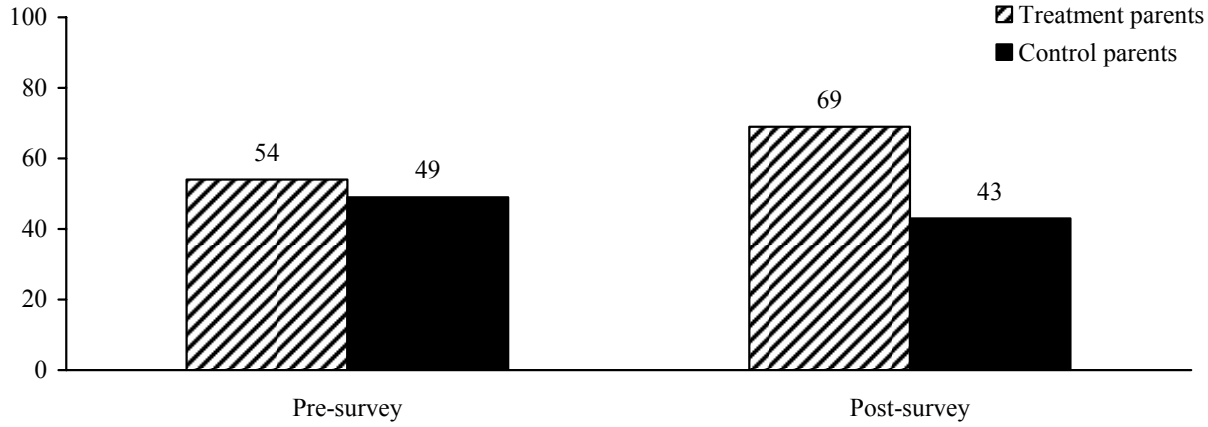
Extent of use	Total (N=291)	Treatment (N=137)	Control (N=154)	T-C	p-value
Number of days of computer use at work (of those who were employed) each week					.22
Not at all	2%	2%	2%		
1 to 2 days a week	14	12	16		
3 to 4 days a week	16	10	21		
5 or more days a week	68	76	61		
Number of hours of computer use at work (of those who were employed) each day				+	.01*
Less than 1 hour	21	13	28		
Between 1 to 2 hours	24	19	28		
More than 2 hours	55	69	43		

* $p \leq .05$.

NOTE: Percents may not sum to 100 because of rounding.

SOURCE: eSPARC Post-Intervention Parent Survey, 2005.

Figure 8-1.—Percent of employed parents using computers at work



SOURCE: eSPARC Pre- and Post-Intervention Parent Surveys, 2004 and 2005.

Data from the post-intervention survey also shed some light on the extent to which respondent parents were using computers for various types of activities. As shown in Table 8-3, the most frequent activities (i.e., several times a week) included searching the Internet for information (33 percent), using e-mail (28 percent), and using a word processor (24 percent). For each of these three activities, treatment parents were more likely than their control counterparts to report frequent use. For example, twice as many treatment parents (45 percent) as did control parents (22 percent) reported searching the Internet for information several times a week. Only a few study parents reported using computers for spreadsheets or presentations.

Table 8-3.—Extent to which respondent parent used computers for various purposes

Purpose	Total (N=291)	Treatment (N=137)	Control (N=154)	T-C	p-value
Searching the Internet for information				+	.00*
Less than once a month	43%	29%	56%		
Several times a month	24	27	22		
Several times a week	33	45	22		
Using e-mail				+	.00*
Less than once a month	55	44	65		
Several times a month	17	20	14		
Several times a week	28	36	21		
Typing or using a word processor				+	.01*
Less than once a month	58	49	68		
Several times a month	18	23	13		
Several times a week	24	29	20		
Making or using spreadsheets					.4
Less than once a month	85	81	88		
Several times a month	5	8	2		
Several times a week	11	11	11		
Preparing presentations					.15
Less than once a month	90	89	90		
Several times a month	6	2	9		
Several times a week	4	8	1		

* $p \leq .05$.

NOTE: Percents may not sum to 100 because of rounding.

SOURCE: eSPARC Post-Intervention Parent Survey, 2005.

The majority (59 percent) of respondent parents made use of the Internet at one location or another. The most frequent use (i.e., several times a week) of the Internet included getting information about news, sports, or weather (40 percent), using e-mail or chat rooms (30 percent), and playing games or listening to music (27 percent) (Table 8-4).[62] However, treatment parents were more likely than control parents to report using the Internet for getting news, sports, or weather information on a frequent basis (46 percent, compared with 35 percent for control parents), and for using e-mail or chat rooms on a frequent basis (38 percent, compared with 22 percent for control parents). This finding suggests that the SPARC intervention enabled treatment parents to engage in these two recreational activities that are typically performed at home (as opposed to the workplace).

Table 8-4.—Extent to which respondent parent used the Internet for recreational purposes

Recreational purpose	Total (N=291)	Treatment (N=137)	Control (N=154)	T-C	p-value
Play games or listen to music					.18
Less than once a month	54%	49%	59%		
Several times a month	20	20	20		
Several times a week	27	31	22		
Buy or trade things such as books, clothing, or music					.28
Less than once a month	84	81	87		
Several times a month	10	11	9		
Several times a week	6	8	4		
Use e-mail or chat rooms				+	.03*
Less than once a month	54	46	61		
Several times a month	17	16	17		
Several times a week	30	38	22		
Get information about something that's hard to talk about with other people					.14
Less than once a month	83	78	87		
Several times a month	15	18	12		
Several times a week	3	4	1		
Get news, sports, or weather information				+	.04*
Less than once a month	45	35	55		
Several times a month	15	19	10		
Several times a week	40	46	35		
Get information about hobbies					.43
Less than once a month	57	53	61		
Several times a month	28	31	25		
Several times a week	15	16	15		

* $p \leq .05$.

NOTE: Percents may not sum to 100 because of rounding.

SOURCE: eSPARC Post-Intervention Parent Survey, 2005.

Computer Skills

As shown in Table 8-5, more than half of all respondent parents reported that they could perform some basic computer functions independently, including erasing or deleting files (65 percent), saving files (64 percent), using help menus (61 percent), and printing files (56 percent). However, less than half

[62] It is worth noting that respondent parents from both the treatment and control groups were less likely to make frequent use of the Internet to get information about hobbies, get information about things that are hard to talk about with other people, or buy or trade such items as clothes or music.

reported that they were able to perform other basic computer functions on their own, such as changing fonts (42 percent), attaching documents to e-mail messages (38 percent), installing software (36 percent), bookmarking a webpage (34 percent), and creating bulleted lists (29 percent). However, the majority of respondent parents viewed themselves as being a "beginner" for such advanced computer skills as preparing presentations (80 percent), making or using spreadsheets (76 percent), typing or using a word processor (58 percent), and using e-mail (50 percent) (Table 8-6)

Table 8-5.—Respondent parent's self-assessment of proficiency on basic computer tasks

Computer-related task	Total (N=291)	Treatment (N=137)	Control (N=154)	T-C	p-value
Erase or deleted a file					.07
Not sure	0%	0%	1%		
Have never done this	25	21	29		
Need help to do this	10	9	10		
Can do this by yourself	65	70	60		
Save a file					.49
Not sure	0	1	0		
Have never done this	22	21	24		
Need help to do this	14	11	16		
Can do this by yourself	64	67	60		
Use help menus to find answers to questions				+	.00*
Not sure	0	0	1		
Have never done this	27	20	35		
Need help to do this	11	11	12		
Can do this by yourself	61	70	52		
Print a file					.38
Not sure	0	1	0		
Have never done this	30	29	32		
Need help to do this	13	11	16		
Can do this by yourself	56	60	52		
Select and change fonts in a word processing document					.26
Not sure	2	2	2		
Have never done this	41	38	44		
Need help to do this	15	13	16		
Can do this by yourself	42	46	38		
Attach a document to an e-mail message					.07
Not sure	0	0	0		
Have never done this	48	43	53		
Need help to do this	14	13	14		
Can do this by yourself	38	44	33		
Install software on a computer				+	.01*
Not sure	0	1	0		
Have never done this	43	35	51		
Need help to do this	21	20	21		
Can do this by yourself	36	44	28		
Make a bookmark for a webpage					.09
Not sure	2	0	3		
Have never done this	48	44	52		
Need help to do this	17	20	15		
Can do this by yourself	34	37	31		

Table 8-5.—Respondent parent's self-assessment of proficiency on basic computer tasks—continued

Computer-related task	Total (N=291)	Treatment (N=137)	Control (N=154)	T-C	p-value
Create a bulleted list in a word processing document					.13
Not sure	3%	3%	3%		
Have never done this	49	46	53		
Need help to do this	19	17	20		
Can do this by yourself	29	34	24		

* $p \leq .05$.

NOTE: Percents may not sum to 100 because of rounding.

SOURCE: eSPARC Post-Intervention Parent Survey, 2005.

Table 8-6.—Respondent parent's self-assessment of proficiency on advanced computer tasks

Computer-related task	Total (N=291)	Treatment (N=137)	Control (N=154)	T-C	p-value
Typing or using a word processor					.10
Beginner	58%	53%	63%		
Average	34	36	31		
Advanced	8	11	6		
Making or using spreadsheets				+	.02*
Beginner	76	70	82		
Average	18	22	14		
Advanced	6	8	4		
Preparing presentations				+	.01*
Beginner	80	72	86		
Average	16	23	12		
Advanced	4	6	2		
Searching the Internet for information				+	.01*
Beginner	44	37	50		
Average	38	40	36		
Advanced	19	24	14		
Using e-mail				+	.00*
Beginner	50	42	59		
Average	31	33	28		
Advanced	19	25	14		

* $p \leq .05$.

NOTE: Percents may not sum to 100 because of rounding.

SOURCE: eSPARC Post-Intervention Parent Survey, 2005.

While treatment parents were significantly more likely than control parents to report competence in only two of the basic computer functions (installing software and using help menus), they were more likely to rate their skills as average or advanced for most of the more advanced computer functions, including making or using a spreadsheet, preparing presentations, searching the Internet for information, and using e-mail.

Attitudes About Computers

Findings from the post-intervention parent survey revealed mixed attitudes toward computers and the Internet. As shown in Table 8-7, an overwhelming majority of respondent parents strongly agreed that computer skills are important for today's job market (92 percent), and that computers help their children do better in school (87 percent). However, many parents professed apprehension about using computers and a lack of confidence in their own abilities. For example, 66 percent strongly agreed that they felt frustrated when using computers, and only 25 percent strongly agreed that they were good at using computers. Almost half (49 percent) strongly agreed that they liked to surf the Internet; but only 18 percent strongly agreed that they wanted to spend more time using computers. Thus, while parents were strong proponents of computers, many personally viewed them as a source of considerable challenge and frustration.

Table 8-7.—Extent of parents' agreement with various statements about computers

Statement	Total (N=291)	Treatment (N=137)	Control (N=154)	T-C	p-value
Computer skills are important for today's job market					.75
Strongly disagree	1%	1%	2%		
Somewhat disagree	0	1	0		
Somewhat agree	6	7	5		
Strongly agree	92	91	93		
Computers help children do better in school					.22
Strongly disagree	0	1	0		
Somewhat disagree	3	1	5		
Somewhat agree	10	9	11		
Strongly agree	87	89	84		
I feel frustrated when I used computers				-	.00*
Strongly disagree	8	11	5		
Somewhat disagree	9	14	5		
Somewhat agree	17	24	11		
Strongly agree	66	50	79		
I like to surf the Internet					.88
Strongly disagree	11	11	12		
Somewhat disagree	12	12	13		
Somewhat agree	28	29	26		
Strongly agree	49	48	49		
I am good at using computers				+	.04*
Strongly disagree	17	14	20		
Somewhat disagree	27	21	32		
Somewhat agree	32	38	26		
Strongly agree	25	27	23		
I want to spend more time using computers					.39
Strongly disagree	40	37	43		
Somewhat disagree	25	27	23		
Somewhat agree	18	17	19		
Strongly agree	18	20	16		

* $p \leq .05$.

NOTE: Percents may not sum to 100 because of rounding.

SOURCE: eSPARC Post-Intervention Parent Survey, 2005.

Treatment parents were more likely to agree that they were good at using computers (65 percent, compared to 49 percent for control parents). They were also less likely to strongly agree that they felt frustrated when using computers (50 percent, compared with 79 percent for control parents). Taken together with the findings on specific computer skills, these perceptions suggest that home access to a computer and the Internet resulted in a strengthened command of computers on the part of treatment parents. At the same time, results from Table 8-7 suggest that treatment parents' *interest* in computers was not significantly enhanced by the intervention, since they were no more likely than control parents to want to spend more time using computers, nor were they more likely to agree that they like to surf the Internet.

Parental Involvement

An important purpose of the study was to assess whether the SPARC intervention would increase parents' involvement in the formal and informal (e.g., hobbies) education of their 5th grade children. The hope was that gaining home access to learning technologies would galvanize parents' interest in the educational process and create opportunities for students and parents to work together on computer-related activities. We examined numerous ways in which parents could be involved with their child's education and interests, including interaction with their 5th grade child on specific school-related tasks (e.g., homework), discussions with their child about their experiences at school and personal interests/hobbies, direct interaction with their child's 5th grade teacher about their classroom behavior or performance, attendance at school-related events (e.g., PTA meetings, science fairs), and interaction with their child on specific computer activities. Each of these is discussed below.

Parental Involvement With Their 5th Grade Children

Parents generally reported considerable involvement in their children's education at home. For example, almost all (98 percent) respondents indicated that they or another adult in the household reviewed their 5th grade children's homework at least once a week to make sure it was done, with 83 percent checking to see that homework was completed 3 or more days in an average week (Table 8-8). In addition, most respondents reported that they or another adult in the household *helped* their child at least once a week with their mathematics (85 percent) or language arts (87 percent) homework, with half providing such assistance 3 or more days a week in mathematics (49 percent) and language arts (49 percent). However, the SPARC intervention did not impact parents' level of involvement with their 5th grade children—i.e., treatment parents were no more likely than control parents to review or help with homework.

Parents also reported that they frequently talked with their 5th graders about their experiences in school, with 63 percent reporting that such communication occurred every day and 26 percent reporting it occurred most days. Treatment parents were no more likely than control parents to talk with their students about their school experiences and/or hobbies.

Table 8-8.—Extent of parental involvement in students' education at home

Parental involvement	Total (N=291)	Treatment (N=137)	Control (N=154)	T-C	p-value
Number of days each week any adult in the household reviewed student's homework to make sure it was done					.66
Not at all	2%	2%	2%		
1 to 2 days a week	15	14	16		
3 to 4 days a week	38	37	38		
5 or more days a week	45	46	44		
Number of days in a typical week any adult in the household helped student with mathematics homework					.59
Not at all	16	20	12		
1 to 2 days a week	36	30	41		
3 to 4 days a week	32	34	30		
5 or more days a week	17	16	17		
Number of days in a typical week any adult in the household helped student with reading, writing, or spelling homework					.64
Not at all	13	16	11		
1 to 2 days a week	38	34	41		
3 to 4 days a week	29	25	33		
5 or more days a week	20	25	16		
Extent to which, in a typical week, any adult in the household talked with the student about his/her experiences in school					.10
Rarely	2	4	0		
Some days	9	11	7		
Most days	26	23	28		
Every day	63	62	65		

NOTE: There were no statistically significant differences between treatment and control for any variables in the table. Percents may not sum to 100 because of rounding.

SOURCE: eSPARC Post-Intervention Parent Survey, 2005.

Parental Involvement in Activities at Their 5th Grade Child's School

Most study parents were involved in at least some school-based activities during the school year, including attending regularly scheduled parent-teacher conference (94 percent), attending back-to-school night (78 percent), fundraising (58 percent), and attending a school or class event (56 percent) (Table 8-9). Less than half reported that they attended a PTA meeting (44 percent, attended a sports event (34 percent), chaperoned a school field trip (25 percent), or volunteered at the school or in the classroom (23 percent). There were no differences between treatment and control parents for any of the school-based involvement items that we examined.

Table 8-9.—Percent of parents who participated in various school-based activities

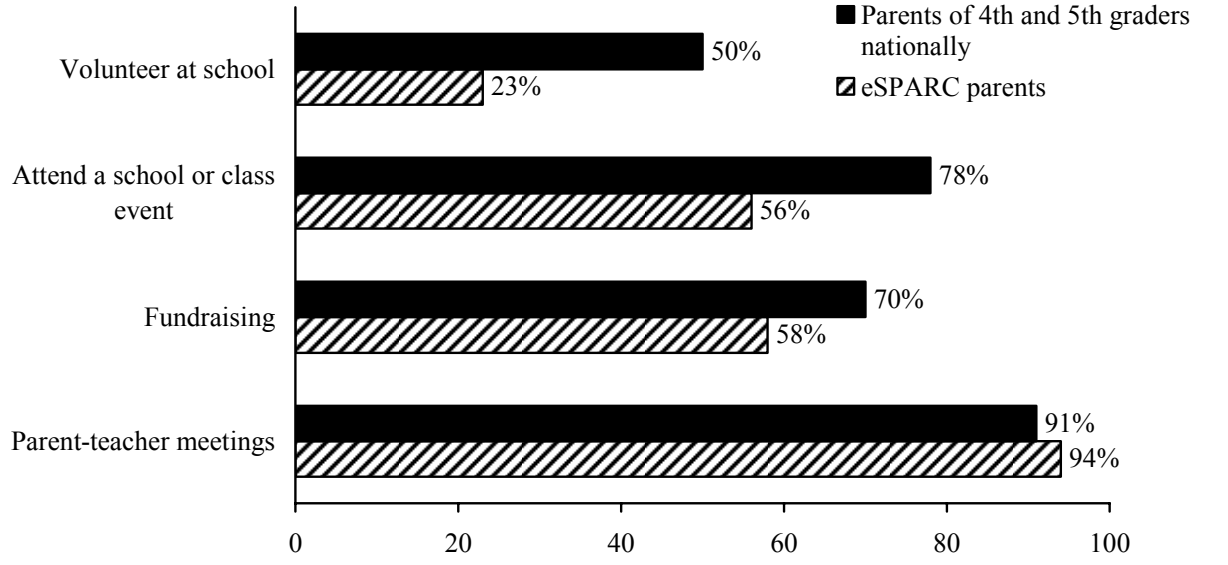
Involvement activity	Total (N=291)	Treatment (N=137)	Control (N=154)	T-C	p-value
Attend a regularly scheduled parent-teacher meeting with child's teacher	94%	96%	92%		.24
Attend back-to-school night or open house at child's school	78	81	76		.29
Participate in fundraising for child's school	58	57	59		.77
Attend a school or class event, such as a play or science fair	56	58	54		.49
Attend a PTA meeting	44	46	44		.77
Go to a sports event at child's school	34	32	36		.51
Chaperone a school field trip for child's class	25	27	22		.33
Volunteer at the school or in the classroom	23	23	23		.96

NOTE: There were no statistically significant differences between treatment and control for any variables in the table. Percents may not sum to 100 because of rounding.

SOURCE: Post-Intervention Parent Survey, 2005.

A comparison of study findings on parental involvement with data generated by the National Household Education Survey (NHES) of 2003 provides a useful benchmark of how the SPARC study sample compares with the national average. For example, as shown in Figure 8-2, 91 percent of parents of 4th and 5th graders reported on the NHES survey that they had attended a regularly scheduled parent teacher conference (compared with 94 percent of parents). The NHES survey also found that 70 percent of parents of 4th and 5th graders nationally participated in school fundraising during the school year (compared with 58 percent of parents), and 78 percent of parents attended a school or class event (compared with 56 percent of parents) (Carver 2006). Parents participating in the study were also less likely than parents of 4th and 5th graders nationally to volunteer at the school (23 percent of parents versus 50 percent of parents nationally).

Figure 8-2.—Parental involvement in activities at school: Comparison of study parents and parents of 4th and 5th graders nationally



SOURCE: eSPARC Post-Intervention Parent Survey, 2005 and the National Household Education Survey: Parent Involvement Component, 2003.

Parental Communication With Their 5th Grade Child's Teacher

Fifth grade teachers in each of the study schools used the teacher log to record the frequency with which each study parent communicated with them about their 5th grade child. Results from the fourth quarter teacher log indicate that study parents most commonly initiated contact with teachers via typed or hand-written notes, with 56 percent of parents doing so at least once during the fourth quarter of the school year (Table 8-10). Almost half (47 percent) of study parents visited teachers at school at least once during the fourth quarter, and 33 percent contacted teachers via telephone. Only 3 percent used e-mail to contact a teacher. In the majority of cases, parents initiated contact because of their children's behavior or with regard to a homework assignment (not shown in tables).

Table 8-10.—Extent of parental communication with teachers during the final grading period (as reported by the child's teacher)

	Total (N=310)	Treatment (N=157)	Control (N=153)	T-C	p-value
Extent to which parents contacted teachers via typed or hand-written note during the previous grading period					.82
Never	44%	42%	46%		
Once	23	24	22		
Twice	16	18	14		
Three times	8	7	9		
Four or more times	9	9	9		
Extent to which parents visited teachers at school					.24
Never	53	51	54		
Once	29	29	30		
Twice	10	10	10		
Three times	5	6	5		
Four or more times	3	4	1		
Extent to which parents contacted teachers via telephone during the previous grading period					.27
Never	67	66	69		
Once	16	17	15		
Twice	9	7	12		
Three times	3	3	2		
Four or more times	5	7	3		
Extent to which parents contacted teachers via e-mail during the previous grading period				+	.02*
Never	97	95	99		
Once	2	3	1		
Twice	1	3	0		
Three times	0	0	0		
Four or more times	0	0	0		
Extent to which teachers contacted parents via a phone call, personal e-mail, or hand written note					.62
Never	27	28	26		
Once	20	17	23		
Twice	23	23	23		
Three times	10	11	9		
Four or more times	20	21	19		

* $p \leq .05$.

NOTE: Percents may not sum to 100 because of rounding.

SOURCE: eSPARC teacher log, fourth quarter, 2005.

For most types of parent-initiated contact with teachers, there were no significant differences between parents from the treatment and control groups. An exception was contact initiated by e-mail during the fourth quarter, where 6 percent of treatment parents contacted teachers by e-mail, compared with 1 percent of control parents. In spite of this statistically significant difference, it should be noted that the vast majority of treatment parents did not take advantage of their home Internet access to contact teachers by e-mail.

Parental Involvement With Their 5th Grade Child on Computers and the Internet

The majority of study parents routinely interacted with their 5th grade children about computers and the Internet. For example, 76 percent of parents reported that they or another adult in the household had talked with their 5th grade child about something they saw or did on a computer in the previous week, while 43 percent had asked their child to find information on the Internet (Table 8-11). Almost two-thirds (60 percent) reported that an adult in the household used the Internet several times in the previous month to help their child with school work, and 48 percent used the Internet to help their child find information about an interest or hobby.

Table 8-11.—Extent of parent interactions with students involving computers

Parent interaction with student	Total (N=291)	Treatment (N=137)	Control (N=154)	T-C	p-value
Number of days in the last week any adult in the household talked with their 5th grade child about something he/she did or saw on a computer					.27
Not at all	24%	24%	23%		
1 to 2 days a week	44	39	48		
3 to 4 days a week	23	25	22		
5 or more days a week	9	12	7		
Number of days in the last week any adult in the household asked their 5th grade child to find information on the Internet				+	.00*
Not at all	56	41	71		
1 to 2 days a week	29	37	23		
3 to 4 days a week	10	16	5		
5 or more days a week	4	7	1		
Extent to which any adult in the household used the Internet to help their 5th grade child with school work in the last month				+	.00*
Less than once a month	41	24	57		
Several times a month	30	36	23		
Several times a week	30	40	20		
Extent to which any adult in the household used the Internet to help their 5th grade child find information about an interest or hobby				+	.02*
Less than once a month	52	43	60		
Several times a month	29	31	27		
Several times a week	19	26	13		

* $p \leq .05$.

NOTE: Percents may not sum to 100 because of rounding.

SOURCE: eSPARC Post-Intervention Parent Survey, 2005.

These results provide evidence that study parents recognized the potential value of computers and the Internet for helping their children develop their academic skills and pursue their personal interests. Not surprisingly, the SPARC intervention had a significant impact on parents' capacity to use computers with their children—treatment parents reported significantly more interaction involving computers and the Internet with their 5th grade children than their control counterparts. Specifically, treatment parents were more likely to report that an adult in the household had asked their 5th grade child to find information on the Internet in the previous week (60 percent, compared with 29 percent for control parents), used the Internet to help their child with school work at least several times in the previous month (76 percent, compared with 43 percent for control parents), and used the Internet to help their child find information about an interest or hobby at least several times in the previous month (57 percent, compared with 40 percent for control parents).

Parent Employment Status

Over 76 percent of respondent parents were employed in spring 2005, and 85 percent of participating study households reported an annual income of $30,000 or less (not shown in tables). It does not appear that the SPARC intervention had an effect on either of these variables; there was little difference between the treatment and control groups in terms of respondent parent employment status and income level.[63]

Bivariate Comparison of Parent Outcome Factors

Factor analysis was used to examine the relationship between individual items from the spring 2005 parent survey under the following larger constructs: parent computer skills, and three aspects of parental involvement: (1) helping 5th grade child with schoolwork, (2) talking with 5th grade child about school and/or hobbies, and (3) participating in activities at school.[64] As is shown in Table 8-12, parents of treatment students reported stronger computer skills than their control counterparts. However, the SPARC intervention did not affect any of the three aspects of parental involvement that were included in the factor analysis. Taken together, these findings suggest that while home access to computers and the Internet led to a significant improvement in treatment parents' computer skills, it did not compel treatment parents to be more actively involved in aspects of their children's education that did not require the use of a home computer.

Table 8-12.—Comparison of factor outcomes for treatment and control parents

Outcome	Treatment	Control	Sig (T-C)	Effect size
Computer skills	3.17	2.85	0.33**	0.33
Helping 5th grade child with schoolwork	2.96	3.04	-0.08	-0.08
Talking with 5th grade child about school and/or hobbies	2.90	3.09	-0.19	-0.19
Participating in activities at school[1]	3.04	2.97	0.07	0.07

** $p \leq 0.01$.

[1]Includes attending back-to-school night, chaperoning a school field trip, attending a school or class event (e.g., play or science fair), and volunteering in the school or in the classroom.

NOTE: All of the factor scores reflect means on a 5-point scale.

SOURCE: eSPARC Post-Intervention Parent Survey, 2005.

[63]Nor was there a difference between the treatment and control groups with respect to the percentage of nonrespondent parents who lived in the household who were employed (among households that had two parents).

[64]See Chapter 3 and Appendix A for a detailed description of the process used to develop factors, as well as the individual items that were considered and eventually included in the factors that appear in this chapter.

Summary

At the outset of the program, parents were told that their SPARC computer was a resource meant to be shared by all household members. As such, parents were strongly encouraged to use their home computer to augment their own educational and professional skills, as well as to use the computers with their children in ways that would positively impact their engagement and achievement at school. To the extent that treatment parents allowed themselves to take advantage of this opportunity, we expected to find an increase in computer usage and improved computer skills. It was also expected that SPARC would modestly improve parents' computer skills and would lead to greater academic involvement with their 5th grade children on school-related activities.

Indeed, the intervention did have a significant impact on treatment parents, leading to more frequent computer and Internet usage, as well as stronger computer skills. With respect to computer use, it should be noted that while a large majority of parents (treatment and control alike) were making some use of computers at various locations, and many were using the Internet, treatment parents overall seemed to be making more frequent use than control parents, presumably as a result of home computer access. However, the SPARC intervention did not affect parents' overall involvement in their children's homework or increase their level of interaction with their children about school and/or hobbies. Nor did it influence parental participation in activities at school.

Finally, the specific areas of parental involvement where the SPARC intervention did make a difference were those that required the use of a computer or Internet access. Thus, while study findings failed to uncover any overall impact on parental involvement that was *not* directly linked with computers or the Internet (e.g., amount of time helping their child with homework), the SPARC intervention did result in greater parental involvement for specific interactions that involved computer and/or Internet use (e.g., using the Internet to help their child with school work).

9. LESSONS LEARNED

The Evaluating State Education Technology Programs Grant program was designed to provide states the opportunity to develop research tools and encourage experimental design studies of educational technology interventions. The evaluation of SPARC, funded through this federal grant program, enabled the Pennsylvania Department of Education to use random assignment to assess the impact of providing 5th graders from impoverished households with a home computer and Internet access. Study findings reveal that gaining access to a home computer and the Internet significantly increased the frequency of student computer use for educational, informational, and recreational purposes. It also improved computer skills for both students and parents. However, the study did not uncover any evidence that the SPARC intervention had an impact on students' grades or PSSA scores. Nor was there an impact on overall parental involvement.

In considering these findings, we are mindful that any broader conclusions that might be made about the impact of providing home access to computers and the Internet are limited by the context within which the study was conducted—that is, the specific benefits made available to treatment households (as described in Chapter 3), the functionality of the SPARC computers (Chapter 4), the characteristics of the study population (Chapter 5), and the extent to which treatment households made use of their home computers and other SPARC services (Chapter 6). While SPARC was designed to make a wide range of supplemental educational resources available to participants, the findings in Chapter 6 suggest that the study experience of the average treatment group student was limited to the initial training (which primarily focused on setting up the computer and basic computer skills) and the benefits of having a home computer and access to the Internet. Further, because SPARC was viewed as an out-of-classroom intervention, teachers were not asked to exert any pressure on treatment students to make use of these tools for school-related purposes. As a result, the extent to which treatment students benefited from the SPARC intervention was largely dependent on their own initiative.

Lessons Learned Regarding Home Computer Initiatives

The findings presented in this report provide evidence that absent a broader educational framework, the educational benefits of providing home PCs and Internet access to 5th grade students are limited—e.g., an increase in home computer use for academic purposes, an increase in computer skills. At the very least, our research should serve as a warning to school districts that "passive" home computer interventions are unlikely to yield positive effects on student achievement, student engagement, or parental involvement.

Educational initiatives looking to build on findings from the SPARC evaluation might explore the feasibility of supplementing the provision of home PCs with a dynamic in-school component that is closely aligned with regular classroom activities, or else an out-of-classroom component that is closely aligned with ongoing academic activities in core subject areas.[65] Such an intervention might include (1) a robust educational framework emphasizing frequent in-class use of learning technologies and/or a mandatory out-of-classroom technology training component, (2) structured opportunities for the out-of-classroom use of computers and the Internet for homework and special projects, (3) home computers with enhanced reliability and functionality (e.g., more memory, faster processing speeds, and faster Internet connections), and (4) timely technical assistance.

[65] Such a study would, however, require that random assignment occur at the classroom or school—as opposed to individual students within a classroom (as was done in the SPARC evaluation), so that all students within a classroom have equal access to a home computer.

This section outlines a series of lessons learned regarding the use of refurbished computers and the provision of training and technical assistance in home-based educational initiatives. These recommendations reflect, in part, suggestions made by SPARC staff and the treatment families that participated in the focus groups. They also reflect our own observations about best practices that have been successfully adapted by SPARC and other home-based computer educational projects.

Using Refurbished Computers in Home-Based Educational Initiatives

Anticipate that some cost-savings associated with the use of donated PCs may be offset by the need to refurbish the computers and provide ongoing technical support.[66] The use of refurbished PCs represents a low-cost approach for providing families with access to a home computer. However, as noted in Chapter 4, there are also several potential drawbacks to relying on refurbished computers—e.g., the poor quality and unreliability of some older models, the time and expense required to upgrade used computers so that they can make use of current software programs, and the potential for a high rate of failure for specific components. Educational initiatives that intend to rely on donated computers should therefore be prepared to devote considerable time and resources to ensure that each PC is meticulously refurbished before it is distributed to a family.

The use of refurbished computers should be accompanied by a responsive and comprehensive technical assistance component, especially if the families receiving the refurbished PCs are unfamiliar with routine computer maintenance techniques. While some problems can be handled by phone, the experiences of the SPARC study suggest that at least some technical assistance issues will need to be handled by either home visits or routine clinics (e.g., at participating schools) where experts can diagnose and fix problems on the spot or arrange for the broken computer to be swapped out for another model. Whether such assistance is provided over the phone or in person, projects should ensure that adequate resources are in place so that repairs can be made in a timely manner. Projects that fail to provide such assistance in a timely manner run the risk that families will ultimately limit or discontinue their computer use over time.

Standardize the process used to refurbish computers. Lessons learned from the original acquisition and distribution process informed the methods used to obtain and set up computers for the control group. Specifically, the same computer models were acquired for all control group households, and the new operating system and software were "ghosted" (as opposed to being manually installed on each PC). The experiences of the SPARC initiative suggest that educational initiatives should seek to acquire the same model of PC and take steps to automate the refurbishing process. Conversely, if it is not possible to acquire a single computer model, educational initiatives should be prepared to develop separate refurbishing procedures for each type of PC they acquire.

Adhere to strict quality control procedures. Open Research (2004) estimates that the average cost of computer refurbishing (including labor, parts, and disposal costs) is $105 per unit—and that it can take two or three donated computers to yield a working reusable one. Educational initiatives should therefore invest the necessary time and resources in identifying PCs that do not meet minimum standards (and hence should not be passed on to participating households unless they can be brought up to such standards). Organizations that refurbish a high volume of PCs commonly complete the following tasks before passing computers on to end-users: (1) testing donated computers to identify problems that will need to be repaired, (2) making necessary repairs (and extracting useable computer parts on PCs that are

[66] It is likely that study participants would have required technical support with a new computer as well. However, it is possible that the frequency of technical assistance requests might have been minimized if households had been provided a new computer that had more memory (to handle Internet downloads and recreational software) and was less prone to malfunction.

not repairable), (3) cleaning hard drives of existing data so that none of the donor's information remains, (4) installing clean operating systems and other software to make computers up to date and fully functional, (5) running diagnostic software to confirm the system configuration and performance, and (6) conducting a final quality assurance check (e.g., successfully boot each computer from code three times). Educational initiatives might also systematically document the number of donated computers that fail to meet minimum standards to determine whether there is a pattern of technical issues that suggest an inherent problem with the used PCs that are being supplied by a particular donor.

Consider utilizing professional refurbishers. As the preceding recommendation suggests, considerable time and expertise are needed to adequately refurbish donated PCs. Educational initiatives might therefore consider the use of professional refurbishers that have established experience processing a large volume of donated computers. Such third-party organizations are often best able to screen donated equipment, select computers and peripherals that meet appropriate technical requirements, and put the equipment through a rigorous troubleshooting process. However, in cases where the refurbishing process is to be contracted out, educational initiatives should make sure that the organization responsible for the refurbishing process is prepared to devote the time and resources required to ensure that families receive a fully functional computer. They should also explore whether the organization is willing to provide a warranty to ensure that families have access to a working computer for a specific period of time.

Providing Training and Technical Assistance in Home-Based Educational Initiatives

Use multiple training sessions to educate users about the operating capacity of their machines. Studies have found that adding supplemental software to refurbished computers can slow their operation and bring about other related malfunctions. For example, a 1999 study of a home computer initiative in Maryland found that a number of households that added games to their refurbished PCs reported sluggish processing speeds (Bartfai et al. 1999). In light of the potential for such problems, there was some discussion at the beginning of the SPARC study as to whether treatment households should be prohibited from adding any software to their PCs. Ultimately, treatment households were allowed to add new software programs to their refurbished computers. This decision was based, in large measure, on the realization that there was no practical way of denying treatment households the right to supplement the software supplied through the SPARC initiative with software programs that would be of interest to individual family members.

To prevent the types of problems experienced by the Maryland initiative, the introductory training provided to treatment households covered the potential consequences of loading too many additional software programs to the SPARC computers. Given the importance of this topic, we recommend that educational initiatives use multiple training sessions to reinforce the message that refurbished computers can only process so much information before they slow down or fail altogether. This training can also be used to educate novice users about the potential impact of downloading incompatible spyware blockers and recreational software that consume memory.

Begin voluntary training as soon after the distribution of equipment or services as possible. Educational initiatives that intend to supplement their provision of home PCs with ongoing technology skills training should have curriculum and staff in place to begin training in the week following the distribution of computers. This will enable projects to capitalize on the initial excitement that many students and parents experience when they first receive a home computer. It will also provide a timely mechanism for addressing families' immediate questions or concerns—and for reinforcing key points from the introductory training (e.g., the need to limit the number of supplementary software programs added to the computer).

Situate after-hours training activities at a site that is easily accessible to participating households. Educational initiatives that are seeking to implement a home computing initiative in multiple schools should locate their training sessions in either the school attended by the participating students or a neutral location that is well known and easily accessible. The experiences of the SPARC intervention suggest that when trainers are serving several schools within a given district, holding separate sessions at each school is likely to eliminate some of the barriers that might otherwise prevent parents from attending.

Provide incentives for families to attend voluntary training sessions that occur in the evening. Educational initiatives that seek to boost attendance at voluntary training sessions might consider whether they have the resources to offer other financial or in-kind inducements to promote attendance at voluntary training sessions. For example, some initiatives offer a well-publicized raffle or door prize (e.g., a digital camera, a coupon to a local restaurant) as an incentive for encouraging participation in after-hours training sessions. In cases where initiatives lack the resources to provide such incentives on a routine basis, an effort could be made to assess whether local community businesses are willing to periodically donate such door prizes or coupons.

Encourage the school's principal or the child's teacher to promote supplemental training. Anecdotal evidence suggests that the active encouragement of a principal at one of the participating elementary schools resulted in increased attendance at the voluntary training sessions. Educational initiatives might consider having principals and/or the child's teacher publicize after-hours technology skills training through letters (on school stationary) and targeted telephone calls.

Make receipt of a home computer contingent on attendance at technology training sessions. Findings from the SPARC study suggest that unless there is a requirement that household members regularly attend technology training sessions, only a few households will likely put in the required effort. Educational initiatives might therefore consider making receipt of a home computer conditional on having eligible students participate in supplemental training. Such a requirement for parents may also be needed for initiatives that are designed to increase parental involvement in their children's education. However, initiatives may also find that mandating regular attendance at training sessions hinders their efforts to recruit participants.

Target supplementary technology skills training to a specific audience. Home computing initiatives that are designed to impact both students and parents should develop separate training components that focus on their distinct training needs. This approach would enable school-based trainers to offer supplementary instruction in basic and advanced technology skills to students during or after the school day. It would also enable trainers to develop parent training that addresses topics that are primarily of interest to adults (e.g., using the Internet for conducting job searches, effective strategies for using computers and the Internet to help with their children's homework).

Anticipate the need for extensive home-based technical assistance. Providing technical assistance via a toll-free telephone helpline can be cost-effective and easy to implement with a large number of households. It also allows for the provision of timely technical assistance by a single provider who needs to address the needs of households that reside across a wide geographic setting. However, such an approach may not be feasible if there are substantial problems with the quality of the PCs that are distributed to participating households. It also may not be feasible to rely on phone-based technical support if the participating households are new to using computers and will require substantial assistance in making repairs or understanding basic technology applications.

We therefore recommend that educational initiatives that plan to rely on refurbished computers anticipate that at least some of their technical assistance will need to be provided through home visits.

Such a requirement will require that a sufficient number of staff be made available to deal with the volume of home visits that may be required to keep pace with the demand for technology assistance (especially at the beginning of the initiative when households are learning their equipment and discovering problems during an initial shake-down period).

Designate staff members who are primarily responsible for providing training and technical support. Home-based computer educational initiatives should not expect one individual to be in a position to handle all of the tasks associated with maintaining PCs and addressing participants' training needs. The use of specialized staff to handle each function associated with a dynamic home computing initiative (e.g., program oversight, refurbishing, technical assistance, training, website development) will increase the likelihood that training is provided in a timely and effective manner. For projects on an accelerated timeframe, the use of specialized staff will also give trainers sufficient time to develop training materials needed to meet the diverse learning needs of students and parents. Finally, in projects serving multiple districts or schools, such an approach may enable trainers to modify a generic training package to reflect conditions within a particular district or school (e.g., by aligning broad topics with local lesson plans) and/or the needs of individual students and parents.

Lessons Learned Regarding the SPARC Study Design

Rarely are evaluators provided the formal opportunity to critique their own efforts and reflect on the lessons learned from the methodologies they chose to employ. In announcing the Evaluating State Education Technology Programs Grant Competition, the U.S. Department of Education emphasized its expectation that lessons learned regarding evaluation methods would be widely disseminated. Specifically:

> The purpose of this program is to increase the capacity of States to design, conduct, and procure high-quality evaluations of educational technology. To do so, this competition supports grants to States to: (1) Build their capacity to conduct scientifically based evaluations of educational technology interventions, by planning and conducting an experimental or quasi-experimental evaluation of State-selected educational technology initiatives; and (2) widely disseminate pertinent information based on what is learned about the evaluation methods, practices, analyses, and instruments used, that will help other States enhance their ability to conduct similar evaluations (*Federal Register*, Vol. 68, No. 112, Wednesday, June 11, 2003).

This call to disseminate realistic information to states planning to conduct similar evaluations is both important and timely. An increasing number of federal grants for educational initiatives come with an evaluation requirement that encourages the use of "gold standard" random assignment studies. While many books and journal articles have addressed methodological concerns and benefits associated with random assignment, comparatively few resources are available for state and local officials who are weighing the practical implications of using an experimental design to evaluate a particular educational initiative. Such resources are needed if states are to make informed decisions about whether it is appropriate and feasible to devote the resources required to execute a gold standard study.

Although the SPARC study made use of in-class random assignment to assign students to either a treatment or control group, it did so for an out-of-classroom intervention. As such, the SPARC study circumvented many of the practical, methodological, political, and ethical issues that are commonly

associated with the use of experimental designs in educational settings.[67] While that makes it difficult to reflect on some aspects of random assignment, our experience with SPARC does suggest some practical lessons that states might consider with respect to the design and uses of rigorous educational studies. The following sections focus on lessons learned regarding three broad areas: establishing realistic timetables for rigorous studies, collecting data from study participants, and conducting random assignment studies.[68]

Establishing Realistic Timetables for Rigorous Studies

Set aside enough time prior to random assignment for planning, recruitment, and preliminary data collection. For random assignment evaluations of educational interventions (or any study requiring the recruitment of districts, schools, and/or study participants), timing can be critical. In most experimental and quasi-experimental design studies, there will likely be a strong incentive to begin the intervention period as early in the school year as possible (to maximize its length and allow adequate time to detect measurable impacts). A *minimum* of 9 to 12 months may be needed to prepare for and execute the steps that must commonly occur before random assignment.[69] These steps can include (1) finalizing the study design (e.g., meeting with an advisory panel to discuss steps for enhancing the overall approach), (2) recruiting districts and schools, (3) establishing liaisons who can facilitate study procedures in individual schools, (4) designing a full range of data collection instruments, (5) gathering student participant records and data from districts and schools, (6) collecting initial data from prospective study participants, (7) identifying eligible households, and (8) recruiting eligible participants. In considering the time required to complete these steps, several observations about the process that preceded random assignment in the SPARC study are worth noting. Specifically:

- Many of the initial tasks had to be completed while school was still in session, since we needed access to principals and teachers (to gain their approval for participating in the requisite data collection activities) and school secretaries (to obtain up-to-date addresses and telephone numbers for potential study participants).

- Other tasks had to be completed before other activities could begin. For example, the development of the teacher log (originally slated to occur in summer 2004) had to be initiated much earlier than planned to accommodate school staff who were reluctant to participate in the study until they could view the surveys they would be asked to complete.

- Several unanticipated occurrences complicated efforts to recruit study participants. For example, two school districts that expressed interest in the study ultimately had to be excluded. One district had to be excluded because its 5th grade students attended a single middle school that only served 5th and 6th graders (as opposed to a traditional elementary school). The other

[67]The lack of an in-class academic requirement significantly improved our chances of gaining the participation of elementary schools, since teachers were not asked to modify their curriculum or classroom practices as part of the study. Had the study focused on a classroom-based intervention—or had the control group not eventually received the same benefits as the treatment students—we most likely would have encountered greater opposition in some schools. In addition, had the study focused on a classroom-based intervention, we would have conducted random assignment at the classroom or school level (as opposed to randomly assigning individual students to a treatment or control group). This, in turn, would have required a much larger sample size to achieve the same level of statistical power.

[68]These sections are not intended to be a "how-to" manual for designing or implementing random assignment studies. As such, they do not focus on many of the specific methodological issues that evaluators must typically address when designing a random assignment study—including determining the level at which random assignment should occur, constructing an appropriate counterfactual, determining an appropriate sample size, identifying steps that can be taken to maintain the integrity of the study design, and identifying appropriate alternatives to random assignment. While these are all critical issues that need to be addressed as part of the study design phase, they are adequately covered in other publications and beyond the scope of the broad methodological lessons learned as a result of the SPARC study.

[69]This 9- to 12-month timeframe does not include the time required to develop the overall design and obtain funding for study-related activities.

was ultimately removed from the study because its schools had too few students without home computers to support their inclusion in the study.

- A longer start-up phase might have enabled us to identify and recruit contiguous districts and schools, which would have simplified such aspects of the intervention as technical assistance and training. In addition, with more time, we would have been able to administer baseline parent and student surveys prior to random assignment (which would have strengthened our ability to document changes over time in the computer skills and attitudes of study participants).

- Some schools were not able to provide us with their classroom rosters (which were needed to conduct random assignment) until the second week of school. In some cases, this occurred because decisions about school boundaries (affecting which neighborhood school a student would attend) were not made until late in the summer. In other cases, this delay occurred because schools were waiting until decisions about classroom assignments were finalized. As a result, random assignment could not occur until the third week in September, which delayed the start of the intervention to early October.

As these observations suggest, the complexity of experimental design studies and other rigorous evaluations can necessitate an extended start-up phase—especially if extensive legwork is required to recruit school districts, individual schools, and/or study participants. Given the likelihood that unforeseen circumstances are likely to complicate the recruitment process, a lesson from the SPARC study is that rigorous evaluations of education initiatives should anticipate the need to devote a full 9 to 12 months to such start-up activities as planning, recruiting, obtaining consent from study participants, and developing data collection protocols.

Set aside enough time to conduct other tasks associated with the conduct of the study. Following random assignment, Westat conducted a wide range of data collection activities at multiple points in the school year. The experiences of the SPARC evaluation suggest that studies of educational initiatives will need to invest sufficient time and resources to obtain valid and reliable data from study participants. For example:

- Teachers who participated in the initial school recruitment sessions were given an opportunity to review and recommend enhancements to the initial draft of the teacher log. While this required additional effort on the part of evaluation staff, the validity, reliability, and value of the resulting survey instrument was substantially improved. In addition, teachers' willingness to provide the necessary data likely increased as a result of the opportunity that was provided for feedback and comment. Where feasible, we recommend that educational studies offer opportunities for teachers to provide feedback on protocols that they will be required to complete—especially if those protocols are designed to capture information on how (or how often) they perform a task or how well their students are performing on a range of academic or engagement measures.[70]

- All of the survey protocols developed for parents and students were pilot-tested with a small sample of study participants. Nonetheless, interviews conducted after the baseline survey with participating students in one study school revealed sharp differences between how children and

[70]It should be noted that the structure and purpose of the teacher log made it suitable for review by respondents. Specifically, the log was designed to obtain teachers' periodic perspectives on the progress being made by their students for several engagement and academic measures. Such a review may be less necessary if the instrument is only to be completed once, or it obtains information on their opinions, skills, and instructional practices.

adults perceived specific survey items. Specifically, students struggled with interpreting reference periods and time perimeters, integrating their experiences into summary judgments, and comprehending cognitively demanding questions. In hindsight, even more time was needed to test more rigorously the assumptions and language in both the parent and student surveys. Given that research on the design and reliability of surveys for children is scarce, we recommend that educational studies involving youth build in sufficient time to pilot instruments with students who represent a study's target audience.

- Considerable time and effort was required to obtain high response rates for each of the parent telephone surveys. Much of this effort focused on obtaining up-to-date contact information for study participants and making multiple phone contacts with non respondents. This was due, in large part, to the high mobility rate of study participants and the number of households for which accurate contact information was not initially available. Without the cooperation of school administrators and the use of school-based liaisons (see discussion that follows), the resulting response rates on all of our surveys would have been considerably lower. Nonetheless, educational projects seeking to obtain data from a large number of parents should anticipate the need to devote considerable time and resources to obtaining a satisfactory response rate.

Collecting Data From Study Participants

Develop relationships with individuals at the district and school levels. Early in the design of the evaluation, we decided to identify a single individual within each district and school who would be responsible for facilitating study procedures. Establishing liaisons within participating districts and schools proved to be an invaluable way to gain access to study data. District-level liaisons served a variety of purposes, such as providing student-level assessment data and ensuring that schools remained responsive to the needs of the study. School-level liaisons served as our "eyes" on the ground, providing assistance with a range of study activities—including gaining access to student records and contact information, scheduling data collection activities, keeping school principals up to date on study activities, and reminding teachers to stay current on maintaining the teacher log.

Set aside funds in the study budget for incentives. The willing participation of school-level liaisons, teachers, and parents in specific data collection activities was clearly facilitated by the use of financial incentives. Without such incentives, it would have been significantly more difficult, expensive, and time consuming to gather the data needed for the study.

Supplement survey data with face-to-face interviews with study participants. While the data from surveys provided the primary basis for study findings on the impact of the intervention, qualitative data collected from interviews with study participants were very helpful in shedding light on the quantitative findings. For example, the interviews with a sample of treatment and control students in one school made clear that the overall computer and Internet literacy of students was very basic, despite self-reported survey data from students that indicated fairly strong computer and Internet skills. In addition, while survey data from treatment parents suggested considerable difficulty and challenges with the SPARC computers, the focus groups revealed that parents and students alike were profoundly affected in a positive way by the presence of a computer at home.

Conducting Random Assignment Studies

Consider whether the intervention to be examined is ready for the costs and increased scrutiny associated with gold standard studies. Because of the timeline mandated by the federal grant, the study progressed before some aspects of the SPARC intervention were fully developed. Waiting until planning for SPARC was further along might have resulted in a stronger intervention that better reflected the study's original theory of change. This, in turn, might have increased the likelihood that we would have detected statistically significant differences between treatment and control participants for a number of desired outcomes (e.g., student engagement and academic performance, parental involvement). However, it is naïve to assume that any intervention conducted in a real-world setting will be implemented exactly as planned (or under optimal circumstances). The experiences of the SPARC evaluation reinforce the need to be realistic about the context within which educational studies typically occur. This does not suggest that the complexity and instability that characterize many educational institutions should deter states from undertaking random assignment studies. In fact, Cook (2002, p. 159-160) argues:

> To those whose operating premise is that schools are complex social organizations with severe management and implementation problems, randomized experiments must seem premature. But random assignment does not require well-specified program theories, or good management, or standard implementation, or treatments that are totally faithful to program theory, even though these features definitely make evaluation much easier…We must also remember that the aim of experiments is not to explain all sources of variation. It is to probe whether a reform idea makes a marginal improvement in staff or student performance over and above all the other background changes that occur. It is not an argument against random assignment to claim that many reform theories are underspecified, some schools are chaotic, treatment implementation is highly variable, and treatments are not completely theory-faithful. Random assignment does not have to be postponed while we learn more about school management and implementation. However, the more we know about these matters, the better we can randomize, the more reliable effects are likely to be, and the more experiments there will be that make management and implementation issues worthy objects of study within the experiments themselves.

With this in mind, we have wrestled with the question of whether there is an optimal time in a program's lifecycle to conduct a gold standard study. Rossi and Freeman (1989, p. 304) note that "randomized experiments are not fruitful in the very early stages of program development, when features of a program often need to be changed for the sake of perfecting the treatment or its delivery." Yet, there may be times when public officials require information about the impact of a new program as quickly as possible. In such cases, the need to conduct a rigorous evaluation early in a program's lifecycle may supersede concerns about the extent to which the program is fully developed or being implemented as planned.

Ultimately, states must determine how best to allocate the finite resources they have at their disposal for conducting educational studies. Our experience with SPARC certainly suggests that some programs are in a better position to implement their specified theory of change than others. By this, we do not mean that the theory must always be implemented "to code." Rather, the processes and activities inherent in the theory should be developed adequately before the intervention (and the corresponding study) begins. As discussed by Schneider et al. (2007, p. 36):

> Questions about whether a widely used educational intervention has systematic effects on student learning outcomes are often best answered by large-scale randomized field trials. However, such studies can be very costly to implement, particularly when treatments are assigned at the school level, requiring the inclusion of a sufficient number of schools to detect treatment effects. When trying to measure changes in performance, such as gains in achievement, accurately assessing growth requires that trials be conducted over a sufficient period of time, typically at least a year, which also adds to the costs of fielding the study. Given such costs, it is particularly important that these studies be well-designed, have a strong theoretical grounding, and be adequately informed by prior research. In some cases the research base may be insufficient to justify fielding an RCT. In such cases, researchers may need to conduct preliminary descriptive studies or smaller-scale randomized studies to determine whether an intervention is sufficiently promising to warrant large-scale implementation and to develop adequate measures of the variables of interest.

Since it is not possible to apply the gold standard in all cases, states should be strategic when thinking about how and when to make use of the strongest and costliest of all evaluation tools. A lesson from SPARC is that there is merit in waiting until a program has matured before it is considered "worthy" of the increased costs and scrutiny that come with using an experimental design. At the very least, random assignment studies (and other rigorous evaluation designs) of new programs are best utilized after a feasibility phase during which basic aspects of implementation are ironed out. Otherwise, states run the risk of "building the plane while flying it."

Recognize that the strength of the intervention may have to be compromised to accommodate the study design—and vice versa. The SPARC evaluation was intended to address three potentially conflicting objectives. First and foremost, the 3-year study was designed to evaluate the impact of providing 5th graders from impoverished households with a home computer and Internet access. A second study objective was to examine a low-cost and easy-to-replicate approach for addressing the digital divide and meeting the diverse learning needs of underserved students. The third study objective was to explore the use of random assignment as a method for providing public officials with reliable information about innovative and successful educational strategies.

Early in the study, we came to the realization that achieving all of these objectives within a limited timeframe would be challenging, if not impossible—and that many of the decisions regarding the design of the intervention and the study would require compromise and mitigation of one or more of these goals. Because of the conditions under which the SPARC study was funded,[71] several key decisions regarding the SPARC intervention ultimately favored the need to maximize the integrity of the experimental design over the desire for a robust and replicable intervention. Specifically:

- The decision to focus on 5th grade students reflected the availability of state assessment scores in two core subjects as a measure of student achievement, the ease with which classroom random assignment and data collection could be done (since students only had a single teacher), and the ability of 5th graders to use computers and reflect on their educational experiences.

[71] Specifically, the U.S. Department of Education's Evaluating State Education Technology Programs Grant Competition was designed to promote "gold standard" research studies by building the capacity of states to design and conduct scientifically based evaluations.

- The study design required at least 20 elementary schools to detect meaningful impacts on students and parents. This requirement made it difficult to situate the study in a single Pennsylvania school district (unless we focused on Philadelphia or Pittsburgh).[72] It therefore became necessary to recruit multiple districts that both satisfied our selection criteria (see Chapter 3) and were willing to participate in the study. The four districts that ultimately participated in the study were not geographically contiguous, creating numerous logistical challenges for the intervention (most notably, the provision of timely technical assistance and training).

- The decision to utilize in-classroom random assignment made it virtually impossible to incorporate an academic, classroom-based component into the intervention (since some teachers were hesitant to assign homework that required the use of learning technologies unless all of their students had home access to a computer and the Internet). Thus, the intervention lacked a critical link to the classroom that might have led to a greater impact on student achievement.

It is virtually impossible for public officials and evaluators to avoid the delicate balancing act required to maintain *both* a robust evaluation design and a strong intervention. State and local districts looking to employ a rigorous study design to evaluate an educational objective should expect to confront a range of difficult decisions. While some of these issues can be anticipated during the initial planning phase, others will likely emerge well after resources have been committed and key implementation activities have begun. This balancing act makes it even more critical that researchers document the range of difficult decisions that are made throughout the planning and conduct of their experimental studies. Such documentation will allow consumers of educational research to consider the context within which impact findings occurred. It may also provide guidance to other evaluators who are looking to adapt the study design in other settings.

Anticipate the need to wait several years for valid and reliable study findings. States looking to use random assignment studies to inform decision-making should realize at the outset that, when it comes to experimental designs, patience is indeed a virtue. Rossi and Freeman (1989, p. 306) note that "randomized experiments are costly and time consuming," concluding that they should not be undertaken "when information is needed in a hurry." In fact, as the discussion of timetables earlier in this chapter suggests, a minimum of 9 to 12 months may be needed prior to random assignment to recruit study participants, develop data collection protocols, obtain informed consent, and collect baseline data. Depending on the length of the intervention, significantly more time will likely elapse before researchers can even begin to codify and analyze their data. Studies that rely on student assessments may encounter even longer delays if additional time is required for states or localities to make the data files available for analysis. Accordingly, states could wait as long as 3 years before receiving findings from random assignment studies that are designed to track students over a single school year. As such, public officials and policymakers looking to receive valid and reliable information in an abbreviated timeframe should consider the years that are often required to conduct a rigorous evaluation before settling on an experimental design.

It should also be noted that it is not uncommon for random assignment studies to extend beyond the tenure of those who called for the study in the first place. In fact, all of the principal players within the Pennsylvania Department of Education who participated in the conceptualization and implementation of SPARC had moved on to other jobs before the final report was published. Given the time required to conduct rigorous studies, one option is for states to request that raw findings be made available for

[72] As discussed elsewhere, initial efforts to locate the study in three contiguous districts failed because one of the districts had a different configuration for its entire population of 5th grade students.

internal decision-making as soon as possible. This could allow states to make informed decisions even while some aspects of data collection and/or analysis are still underway. In highlighting this option, we are *not* suggesting that critical steps in the design and conduct of the study be circumvented to accommodate political or policy needs. Nor are we recommending that evaluators turn over findings that have not been fully validated. We are, however, suggesting that evaluators be mindful of the decision-making needs of states and—to the extent possible—act accordingly. In the case of SPARC, the sharing of such preliminary findings allowed Pennsylvania officials to consider a range of policy options well before the final report was even begun.

Be aware of the tension between the value-added of experimental studies and the risk of small-impact or no-impact findings. In discussing experimental design studies, Gueron (2002) notes that "rigor has its drawbacks"—adding that "high quality research must continuously compete with the claims of greater success based on weaker evidence." Using a hypothetical example, she describes the tension for public officials who must weigh the benefits of using a rigorous study design versus the risk that they are generally less likely to detect statistically significant findings:

> It takes courage for political appointees to favor independent studies that measure net impacts. Aside from the normal desire to control the story, the challenge comes from the fact that impacts are almost always smaller than outcomes. For example a job training program may accurately claim that 50 percent of enrollees got jobs, only to have this deflated by an impact study showing that 45 percent of the control group also found work, meaning that the program actually produced only a modest 5 percent point increase in employment. It is much easier to sell success based on 50 percent than the 5 percent, and particularly bedeviling to state that a particular program produced a five percentage point gain when another one (spared the blessing of a quality impact study) continues to trumpet its 50 percent achievement.

The example put forth by Gueron illustrates how the net impacts (i.e., the difference between treatment and control group participants on a given outcome) for most programs will pale in comparison to the outcomes that would have been observed through less rigorous evaluation methodologies. Moreover, the risk that an experimental design will uncover little or no impact is even greater in studies with small sample sizes, since their smaller sample sizes make it more difficult to detect statistically significant findings. Further, even educational studies that uncover statistically significant results may not have enough students in the study sample to assess whether such differences are greater for specific subgroups.

By emphasizing the inherent "risks" of choosing random assignment over alternative methodologies, we do not mean to suggest that states should play it safe and focus on program outcomes. On the contrary, states stand to benefit from experimental study findings, even in cases where there is no net impact on a treatment group for key outcomes. The use of an experimental design for the SPARC study allowed for a rigorous assessment of the educational impact of providing 5th graders from impoverished households with a home computer and Internet access. By supporting this study, the Pennsylvania Department of Education enhanced its capacity to disseminate information about the likely costs and educational benefits of home-based computer initiatives. Equally important, the tools and knowledge gained from SPARC represent a strong foundation upon which Pennsylvania and other states can formulate rigorous studies that examine the impact of providing home computers to students in schools that are proactively using educational technologies to improve academic performance.

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APPENDIX A: NOTES ON THE STUDY METHODOLOGY

NOTES ON THE STUDY METHODOLOGY

This appendix provides additional information about the statistical and analytical methods used throughout this report. Specifically, detailed information is provided about the procedures used to conduct the factor analysis and multivariate analyses (including multilevel analysis).

Factor Analysis

For the student and parent surveys and teacher log, multiple questions were developed around key constructs/outcomes such as student engagement in school, student computer skills, and parental involvement. While analyses at the item level are informative, they can not conclusively provide evidence about the broader constructs/outcomes. Therefore, factor analysis was used to create meaningful scales for these key constructs/outcomes so that we could (1) detect the program's impact on these broader indicators, and (2) collapse a large number of variables into a smaller number of factors for the multivariate analyses (see next section).

The scale development involved two steps. The first step was to explore the item-scale relationships. The process was both theory driven and data driven. We first identified and grouped items believed to be indicators of larger outcome constructs (e.g., student engagement, student attitudes toward computers, student computer skills, and parental involvement). During the process, multiple imputation and/or reassignment of values for responses such as "don't know," "not applicable," and missing responses from skip patterns were recoded to ensure that cases were not deleted listwise. Since many of the items were categorical variables, polychoric correlation matrices were used with the weighted least squares method. The proposed items were then included in a series of exploratory factor analyses (EFA) to assess item-factor relationships. The judgments of the factor structures were based on whether the proposed items produced the maximum amount of variance, and on how strong the observed correlations were among those items. The procedures were conducted in LISREL version 8.72 using the principal component estimation method.

Within each model, items that were not strongly correlated with other items were dropped from the factor. In addition, the EFA results informed how items should be organized within a construct. For example, we originally theorized that nine items from the student survey would form the student engagement factor. However, the EFA results revealed that the items that composed the student engagement factor actually comprised two distinct components. Specifically, the principal component method identified one combination of variables that yielded a large amount of variance that appeared to be related to one component of student engagement. It also identified another set of variables that yielded a large amount of variance that appeared to be related to another component of student engagement. After we examined response patterns and explored the theoretical grounds for differentiating two constructs, we decided to use the two components that emerged from the original nine items. These factors were renamed "interest in schoolwork," and "participation in schoolwork." After several iterations of variable selection and derivation, the final items to be included within each factor were identified.

The second step was to construct the scales using factor loadings for each item. We used confirmatory factor analysis (CFA) to estimate the factor loadings in LISREL. The polychoric correlations were generated as the input data and were analyzed in LISREL. The items included each factor, its factor loadings, and several fit indices, as presented in Table A-1. All of the survey items identified to construct the factors in this study demonstrated strong item-factor correlations and indicated reasonable model-data fit. For example, three factors appeared to be related to student engagement. The

five items measuring the student behaviors toward schoolwork composed the first factor. The factor loadings for these three items ranged between 0.244 and 0.657. Since the factor loadings are correlations between the variables and factors, the squared factor loading is the percent of variance in that variable explained by the factor. In addition, one can add the squared factor loadings for each variable within a factor and divide by the number of variables to obtain the percent of variance in all the variables accounted by the factor. Using this method, about 21 percent of variance in the five items was explained by this factor. Similarly, the second factor was composed of four items that measured the student's interests in schoolwork, and about 45 percent of variance in the four variables was explained by this factor. The factor scores were then computed for a given case for a given factor by taking the case's score on each variable and multiplying it by the corresponding factor loading of the variable for the given factor, and summing these products. The raw factor scores were standardized with a mean of 3 on a scale of 1 to 5 and a standard deviation of 1. These scales were then analyzed in both the bivariate and the multivariate analyses.

Table A-1.—Individuals survey items to construct various factors, their loadings, and fit indices

Factor/Item	Loadings	Fit indices	
Student Engagement Factors			
Participation in schoolwork			
Student reports working hard and trying his/her best at school	0.651	RMSEA	0.084
Student reports coming to class with homework completed	0.637	CFI	0.905
Amount of time spent doing homework or studying on weekends	0.300	RMR	0.145
Student reports paying attention in class	0.288	GFI	0.909
Amount of time spent doing homework during weekdays	0.244	AGFI	0.867
Interest in schoolwork			
Extent to which students found social studies interesting	0.822		
Extent to which students found math interesting	0.680		
Extent to which students found science interesting	0.601		
Extent to which students found reading, writing, and spelling interesting	0.533		
Teacher perspective on students' engagement—how frequently did student…			
Work to the best of his/her ability on a daily basis	0.854		
Show persistence when confronted with difficult problems	0.786		
Ask informed or insightful questions in class	0.665		
Offer relevant information that was not mentioned in a textbook or previous class discussion	0.540		
Student Computer Attitudes			
Using a computer makes learning more interesting for me	0.740	RMSEA	0.188
I work harder at my assignments when using a computer	0.644	CFI	0.920
I would rather write school reports using a computer than write them by hand	0.550	RMR	0.630
I understand some things better when I use a computer	0.501	GFI	0.963
		AGFI	0.814

Table A-1.—Individuals survey items to construct various factors, their loadings, and fit indices—continued

Factor/Item	Loadings	Fit indices	
Student Computer Skills			
Rename a file	0.843	RMSEA	0.181
Erase or delete a file	0.811	CFI	0.902
Type a story or report on a computer	0.789	RMR	0.333
Save a file	0.772	GFI	0.776
Search for information on the Internet	0.761	AGFI	0.665
Print a file	0.710		
Make a bookmark for a web page	0.699		
Cut and paste words or sentences from one place to another	0.693		
Work on a spreadsheet	0.594		
Attach a file to an email message	0.574		
Find a file	0.569		
Student Computer Use			
For school-related purposes			
Social studies homework	0.821	RMSEA	0.137
Math homework	0.817	CFI	0.922
Reading, writing, or spelling homework	0.800	RMR	0.550
Science homework	0.773	GFI	0.837
Type up homework for school	0.674	AGFI	0.761
Work on a spreadsheet	0.602		
Find information on the Internet for school	0.492		
For recreational purposes			
Talk with a friend using instant messaging	0.932		
Send email messages to friends or relatives	0.887		
Go to a chat room	0.767		
Listen to or download music	0.717		
Play games	0.553		
Parent Computer Skills			
Erase or delete a file (skill level)	0.653	RMSEA	0.000
Attach a document to an email message (skill level)	0.634	CFI	1.000
Type or use a word processor (frequency of use)	0.629	RMR	0.194
Print a file (skill level)	0.622	GFI	0.933
Use email (frequency of use)	0.622	AGFI	0.748
Save a file (skill level)	0.618		
Make or use spreadsheet (frequency of use)	0.613		
Use help menus (skill level)	0.611		
Search the Internet for information (frequency of use)	0.607		
Make or use spreadsheets (skill level)	0.592		
Use email (skill level)	0.590		
Prepare presentations (skill level)	0.579		
Prepare presentations (frequency of use)	0.572		
Search the Internet for information (skill level)	0.531		
Install software on a computer (skill level)	0.511		
Make a bookmark for a web page (skill level)	0.505		
Select and change fonts in a word processing document (skill level)	0.488		
Create a bulleted list in a word processing document (skill level)	0.487		

Table A-1.—Individuals survey items to construct various factors, their loadings, and fit indices—continued

Factor/Item	Loadings	Fit indices	
Parental involvement Factors			
Helping child with schoolwork			
Help with child's math homework	0.807	RMSEA	0.000
Help with child's reading, writing, or spelling homework	0.748	CFI	1.000
Review child's homework to make sure it is done	0.632	RMR	0.050
		GFI	0.976
Talking with child about school and/or hobbies		AGFI	0.911
Talk with child about (his/her) experiences at school	0.964		
Talk with child about (his/her) personal interests or hobbies	0.473		
Participating in activities at school*			
Attend back-to-school night or open house at child's school			
Chaperone a school field trip for child's class			
Attend a school or class event			
Volunteer at school or in the classroom			
Teacher Factors			
Teacher classroom computer requirements			
Assigning homework using a computer and/or the Internet	0.438	RMSEA	0.000
Assigning work involving practice tutorials or drills using computers	0.442	CFI	1.000
Assigning work involving typing a story or report using a word processing application	0.546	RMR	0.179
Assigning work involving research using the Internet	0.567	GFI	0.869
Assigning work involving computers for drawing or painting software	0.481	AGFI	0.434
Assigning work involving displaying information using charts or graphs	0.834		
Assigning work involving calculations with computers or spreadsheets	0.780		
Teacher computer use			
Gathering information on the Internet for planning lessons	0.840	RMSEA	0.000
Creating instructional materials	0.747	CFI	1.000
Using Internet to access research about teaching and learning	0.709	RMR	0.235
Incorporating web content into lesson plans	0.604	GFI	0.706
Maintaining administrative records	0.596	AGFI	0.625
Creating classroom presentations	0.570		
Using email to communicate with students' parents	0.548		
Using email to communicate with students outside of the classroom	0.544		
Using email to communicate with colleagues/other professionals	0.401		
Teacher computer attitudes (extent of agreement with the following)			
It engages the students in challenging and authentic tasks	0.851		
It develops critical and creative thinking skills	0.826		
It contributes to students' increased interest in school	0.805		
It promotes self-motivated learning and a sense of exploration	0.801		
It enhances the curriculum and connects it to real-life situations	0.761		
It helps students search for/communicate information effectively	0.704		
It allows for more individualized instruction	0.658		
It encourages parental involvement in the learning process	0.504		
It takes away classroom time best spent on other activities	-0.382		

*The factor was based on a simple composite score, and so no factor loadings are available for this construct.

SOURCE: eSPARC Post-Intervention Student Survey, 2005; Post-Intervention Parent Survey, 2005; Teacher Survey, May 2005; teacher log, fourth quarter 2005.

Multivariate Analysis

In addition to the bivariate analyses, we employed multivariate analyses to examine the extent to which observed differences between treatment and control groups could be attributed to the SPARC intervention. The multivariate analyses involved multiple regression analyses and multilevel linear models (or hierarchical linear modeling—HLM) to examine the average program impact. Further, analyses involving separate multiple regression and HLM models with interaction terms were conducted to examine the impact of the intervention on different subgroups. These multivariate methods have the following advantages, compared to the bivariate analyses: (1) providing more accurate estimates of impact; (2) explaining the extent to which other variables may have affected the outcomes; and (3) shedding light on the conditions under which outcomes may be different for specific subgroups.

Model Selection: One Level (Multiple Regression) or Multilevel (HLM)

Recognizing the nesting structure of school settings, we used HLM as the initial conceptual model for student outcomes. In other words, student outcomes are nested within classrooms within schools. One of the first decisions in model selection is to empirically verify whether the data support the conceptual model. We examined a series of unconditional models to decompose the variance of each dependent variable into variance components for three hierarchical levels—student, classroom, and school. Table A-2 presents the variance components and intraclass correlations (ICCs) for each of the student outcomes. For example, for the student grades in reading outcome, the variance was decomposed into 0.341 at the student level, 0.045 at the classroom level, and 0.055 at the school level. Although most of the variance for this outcome existed at the student level, a significant proportion existed between classrooms as well as between schools. With respect to the ICC, about 10 percent of variance for this outcome was explained between classrooms, and about 13 percent was explained between schools.

Table A-2.—Unconditional model indicating variance components for SPARC outcome measures

Outcome	Variance at hierarchical level			ICC	
	Student	Classroom	School	Classroom	School
Student grades: Language arts	0.341	0.045	0.055	0.102	0.125
Student grades: Science	0.307	0.063	0.080	0.140	0.178
Student grades: Social studies	0.354	0.049	0.131	0.092	0.245
Student grades: Math	0.468	0.060	0.000	0.114	0.000
Absence	61.258	0.098	0.006	0.002	0.000
PSSA: Reading scale scores	33407.584	14837.283	615.139	0.304	0.013
PSSA: Math scale scores	33114.657	8179.969	111901.884	0.053	0.730
Computer use	1.004	0.000	0.002	0.000	0.002
Computer skills	0.980	0.013	0.007	0.013	0.007
Computer attitudes	0.952	0.044	0.008	0.044	0.008
Student engagement	0.842	0.149	0.003	0.150	0.003
Parental involvement	0.922	0.011	0.044	0.011	0.045

SOURCE: eSPARC Post-Intervention Student Survey, 2005; Post-Intervention Parent Survey, 2005; Teacher Survey, May 2005; teacher log, fourth quarter 2005.

Outcomes that had classroom and school levels with ICCs of more than 10 percent of the variance were included in the HLM models. Consequently, student achievement outcomes (i.e., PSSA scores and grades) were included in HLM models with 2- or 3-level structures, while other intermediate student

outcomes (i.e., computer use, computer attitudes) were included in single-level multiple regression models.[1]

Analysis With Multiple Regression

Multiple regressions were used for student (i.e., computer use, computer attitudes) and parent outcomes where the ICC for both classroom and school was less than 10 percent. Our regression models included the following variables:

- Study status—a dichotomous variable indicating whether or not students were in the treatment;
- Parents' educational attainment—an ordinal variable measuring parents' highest level of educational attainment (less than high school, high school, and more than high school degree);
- Student gender—a dichotomous variable indicating whether or not students were male;
- Student participation in special education programs—a dichotomous variable indicating whether or not students were enrolled in a special education program;
- Student participation in free or reduced-price lunch—a dichotomous variable indicating whether or not students received free or reduced-price lunch;
- Student race/ethnicity—a dummy variable indicating whether students were White or some other race/ethnicity; and
- Language spoken at home—a dichotomous variable indicating whether students primarily spoke English or another language at home.

The following generic model was used to examine the impact of the SPARC intervention on the various intermediate student and parent outcomes:

> Y (Outcome) = a +b1*(Treatment) + b2*(Parents' educational attainment) + b3*(Student gender) + b4*(Student participation in special education programs) + b5*(Student participation in free or reduced-price lunch) + b6*(Student race/ethnicity) + b7*(Language spoken at home) + Error

Analysis With Hierarchical Linear Modeling

Based on the results of the unconditional models, we decided to use HLM to examine whether the SPARC intervention had a statistically significant impact on the following student achievement outcomes: PSSA mathematics and reading scale scores and grades earned for language arts, mathematics, science, and social science. Based on the amount of variance observed from the unconditional models, PSSA reading scale scores, math grades, and social study grades were examined within 2-level HLM models, while the other outcomes were assessed within 3-level HLM models.

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[1] The student engagement outcome was included in the regression models with other intermediate outcomes, despite having 15 percent of variance at the classroom level.

To address the question of program impacts, we specified two sets of models. The first model was adjusted only for demographic and household characteristics, as well as such pre-intervention conditions as grades earned in 4th grade. In addition to including demographic and pre-intervention variables, the second model included such intermediate (i.e., post-intervention) outcomes as student computer use and parental involvement. This second model was only used to examine the program impact on PSSA reading and PSSA math outcomes, controlling for the pre-SPARC variables and the student and parent intermediate outcomes. The main difference between the two models is that all of the control variables in the first model are exogenous, that is, took place prior to the SPARC intervention. Data collection prior to random assignment was not feasible for many other initial behavioral measures (i.e., computer use, computer attitude), as most of the baseline measures of these measures were collected one month after random assignment. Therefore, the models did not control for initial measures. This is somewhat remedied by the second model which controls for these behavioral measures. However, they are endogenous (intermediate measures) rather than exogenous (initial measures). The model 1 and 2 specifications are similar with the exception that the second model included more variables at level 1. The first HLM model with two levels included the following variables:

Model 1

Level 1

Y = B0 + B1*(Study status) + B2*(Pre-test) + B3*(Parents' educational attainment) + B4*(Student gender) + B5*(Student participation in special education programs) + B6*(Student participation in free or reduced-price lunch) + B7*(Student race/ethnicity) + B8*(Language spoken at home)

Level 2

B0 = G00 + G01*(Computer requirements) + G02*(Teacher experience) + G03*(Teacher education) + U0
B1 = G10 + U1
B2 = G20 + U2
B3 = G30 + U3
B4 = G40 + U4
B5 = G50 + U5
B6 = G60 + U6
B7 = G70 + U7
B8 = G80 + U8
B9 = G90 + U9
B10 = G100 + U10
B11 = G110 + U11
B12 = G120 + U12
B13 = G130 + U13

At level 1, we modeled the student performance Y by using an intercept, B0, and eight variables (B1 through B8). All variables used in the model (except one—"pre-test") were the same as those used in the multiple regression models. The intercept term, B0, equals the mean PSSA scores (or grades) across all groups, classrooms, and schools in the study sample. Study status is a dichotomous variable indicating whether the students were in the treatment group, where the treatment group was coded as 1 and control group was coded as 0.

At level 2, we modeled the intercept, B0, with three variables—teachers' classroom computer requirements, teacher experience, and teacher education. Consequently, the coefficient G00 reflects the difference in the intercepts between the teacher characteristics. As such, level 2 is designed to model

differences between classroom characteristics across the two study designations by controlling for teacher characteristics as classroom-level variables with respect to differences in the intercept between the treatment and control groups.

Analyses With Interaction Terms

To this point, discussion has focused on ways to measure the impact of SPARC on the average child or family. However, impacts can also vary across different subgroups of students or families. For example, the intervention could have benefited high frequency computer users more than low frequency users. Identifying particular subgroups that benefited more or less from the intervention may have important program and policy implications, for example, by suggesting areas where the program could be strengthened or targeted. With a large sample size, all subgroup impacts or all conditional relationships can be studied.

The sample size determined by the power analysis for SPARC was designed to examine the research questions for the average child or family. Because the SPARC sample size was relatively small with respect to studying the impacts on individual subgroups, the analyses with the interaction terms must be viewed as exploratory, and the results should be interpreted with caution.

With this in mind, we focused our analysis on seven variables that could be viewed as potential predictors of outcomes of interest and/or are commonly of interest to policymakers, researchers, and administrators: (1) student computer use, (2) student engagement, (3) student participation in special education programs, (4) parental involvement, (5) student gender, (6) student race/ethnicity, and (7) teacher use of computers in the classroom.[2] Conditional relationships were examined by creating the interaction terms between the group status variable and one of these seven variables to test for moderating effects. The purpose of introducing the interaction terms was to explore whether the SPARC intervention had a moderating effect on some of the variables that could eventually influence student achievement.

The interaction variables were created by multiplying the group status dummy variable by the variables mentioned above. The interaction variables were then introduced into the second HLM model.[3] We tested the interaction models for the PSSA mathematics and PSSA reading student achievement outcomes, but not for student grade outcomes. The decision *not* to use report card data reflected concerns that calculations required to standardize reporting formats across the school districts made grades a less reliable indicator of student achievement for such exploratory analyses.

Tables A-3 and A-4 provide output for the interaction models examining the moderating effects of various variables on PSSA mathematics and reading scores, respectively. For illustration purpose, the "Student use of computers" parameter, -16.02, indicates the predicted slope for the control group—that is, it indicates that an increase in levels of student computer use were associated with lower predicted PSSA mathematics scores for students in the control group. The interaction parameter, 34.55, estimates the difference in predicted slope between the treatment group and control group. The 34.55 value here could be added to the -16.02 value to obtain the predicted slope for the students in the treatment group (18.53). In other words, for students in the treatment group, an increase in student computer use was associated

[2] Other variables, such as household income, were not used because there was not enough variation across the study population to support their inclusion in the model.

[3] The interaction terms were also included in the multiple regression model to examine the moderator effects of the intervention on student intermediate outcomes, but the discussion in this appendix is limited to its use in the HLM model. The processes used to create the interaction terms and the interpretation of the results did not differ between the multiple regression and the HLM models.

with an increase in predicted PSSA mathematics score. However, the difference between the two groups was not statistically significant at the 0.05 level.

Table A-3.—Moderator effects of SPARC on PSSA mathematics scores

Subgroup/moderator	Slope coefficient prediction PSSA math score for control group	Slope coefficient prediction PSSA math score for treatment group	Difference in impact between control and treatment group
Student use of computers	-16.02	18.53	34.55
Parental involvement with 5th grader	-43.35	-16.38	26.97
Student participation in special education	-69.02	-12.40	56.62
Student gender	37.82	83.21	45.39
Student race/ethnicity	-12.18	65.63	77.81
Student engagement	42.27*	63.55*	21.28
Teachers' computer requirement	-14.49	7.5	21.99

* $p \leq .05$.

SOURCE: eSPARC Post-Intervention Student Survey, 2005; Post-Intervention Parent Survey, 2005; Teacher Survey, May 2005; and Household Recruitment Survey, 2004.

Table A-4.—Moderator effects of SPARC on PSSA reading scores

Subgroup/moderator	Slope coefficient predicting PSSA reading score for control group	Slope coefficient predicting PSSA reading score for treatment group	Difference in impact between control and treatment group
Student use of computers	19.49	-7.62	-27.11
Parental involvement with 5th grader	-33.28	0.25	33.53
Student participation in special education	-129.72*	-93.94	35.78
Student gender: male	-35.51	59.11	94.62
Student race/ethnicity: white	97.97	84.09	-13.88
Student engagement	20.92	48.52	27.60
Teachers' computer requirements	-13.37	12.91	26.28

* $p \leq .05$.

SOURCE: eSPARC Post-Intervention Student Survey, 2005; Post-Intervention Parent Survey, 2005; Teacher Survey, May 2005; and Household Recruitment Survey, 2004.

APPENDIX B: STATISTICAL TABLES ON STUDENT GRADES

Table B-1.—Comparison of grades for participating 5th grade students in Allentown

Item	T (n=39)	C (n=39)	Sig
Word analysis, fluency and vocabulary development			
Reads accurately and fluently	2.67	2.64	.81
Applies knowledge of word origins, derivations, root words, affixes and context clues to determine meaning	2.58	2.56	.91
Applies knowledge of antonyms, synonyms, homophones, and compound words to determine meaning	2.67	2.72	.69
Understands and explains the figurative and metaphorical use of words in context	2.64	2.59	.71
Reading comprehension			
Uses reading strategies to comprehend grade-level text	2.63	2.62	.90
Understands information from diagrams, charts, graphs, and maps	2.75	2.74	.95
Analyzes and uses text organization and content to determine the author's purpose	2.65	2.61	.74
Determines and summarizes main ideas and supporting details	2.70	2.58	.32
Supports inferences, conclusions, or generalizations with experiences and evidence from the text	2.59	2.54	.67
Takes logical notes using structured format	2.71	2.67	.73
Reading Comprehension: Distinguishes between fact/opinion and essential/non-essential information within text(s)	2.71	2.74	.79
Literary response and analysis			
Identifies and analyzes the characteristics of common forms of literature	2.65	2.59	.65
Compares and contrasts characters, settings and plots	2.65	2.64	.95
Identifies the conflict and resolution of a plot	2.68	2.64	.79
Identifies themes in a variety of genre	2.59	2.54	.67
Defines the function and effect of key literary devices in literary works	2.56	2.46	.49
Writing strategies			
Focus: writes multi-paragraph compositions around a central themes	2.66	2.76	.41
Content: Uses well-developed content appropriate for the topics	2.63	2.61	.86
Organization: gathers and organizes information for the topic, uses a logical order and meaningful transitions which include a beginning, middle and end	2.68	2.79	.30
Style: conveys meaning through stylistic aspects of composition; develops writer's voice	2.50	2.59	.50
Editing/revising/evaluating: revises and edits manuscripts to improve quality of writing	2.63	2.67	.78
Research and technology: Locates relevant information using printed text and electronic media	2.68	2.79	.30
Written language Conventions			
Uses rules of sentence structure	2.63	2.64	.94
Use rules of grammar	2.58	2.54	.76
Uses rules of punctuation	2.63	2.67	.78
Uses rules of capitalization	2.73	2.74	.91
Spells common frequently used words correctly	2.65	2.72	.58
Speaking and listening strategies			
Asks pertinent questions	2.83	2.87	.70
Organizes & delivers oral communications	2.76	2.84	.43
Takes notes when prompted	2.86	2.92	.44
Collaborates during group work	2.84	2.92	.26

Table B-1.—Comparison of grades for participating 5th grade students in Allentown—continued

Items	T (n=39)	C (n=39)	Sig
Number sense			
Reads, writes, rounds, uses expanded notation, compares, orders & groups whole numbers & decimals	2.78	2.82	.69
Uses a number line to locate and represent: decimals, fractions, mixed numbers, integers	2.72	2.75	.80
Writes prime factorization of numbers through 100	2.71	2.69	.85
Compares fractions & names equivalent fractions	2.74	2.65	.44
Addition & subtraction-accurately computes problems with: positive & negative integers, decimals, fractions, mixed numbers	2.78	2.85	.42
Multiplication-understand, explains and computes problems involving: Decimals, fractions, exponents	2.73	2.73	.97
Division-divides multi-digit numbers	2.69	2.67	.88
Algebra and functions			
Identifies, writes and graphs ordered pairs	2.91	2.78	.12
Applies information from equations and graphs	2.72	2.83	.29
Measurement and geometry			
Adds, subtracts & converts units within systems of measurement	2.46	2.59	.33
Computes perimeter, area, volume & surface area	2.69	2.54	.22
Identifies & defines properties of plane & solid figures	2.81	2.65	.14
Identifies, measures and draws: lines, angles, plane and sold figures	2.75	2.73	.83
Identifies and extends transformations	2.86	2.83	.71
Data analysis and probability			
Organizes, represents, interprets and explains numerical and categorical data	2.73	2.61	.31
Computes data using ranges, mean, median and mode^	2.68	2.74	.57
Predicts or determines all possible combinations/outcomes & calculates the probability of a simple event	2.54	2.58	.79
Mathematical reasoning			
Applies a variety of strategies and generalizations to solve problems	2.57	2.59	.86
Justifies reasonableness of results	2.50	2.51	.92
Content knowledge: demonstrates an understanding of content knowledge as described by grade level standards addressing life, physical, and earth sciences. This knowledge is declarative and constitutes the facts, vocabulary and underlying principles of science	2.92	2.85	.33
Process: demonstrates an ability to engage in the process of inquiry as describes in grade level science standards. This involves asking questions and developing a plan to find the answers to those questions. In doing this inquiry, students engage in classifying, testing, experimenting and determining cause and effect relationships	2.89	2.85	.60
Scientific knowledge: demonstrates the ability to construct new knowledge and to express it as described in grade level standards. The student explains what is known and how it is known to be true	2.79	2.75	.70
Concepts: demonstrates an understanding of grade level content knowledge	2.86	2.88	.91
Process: Demonstrates an ability to reflect upon & apply social studies concepts, draw conclusions and form explanations using these skills	2.81	2.85	.68

NOTE: Grades are presented in their original scale.

SOURCE: Student report cards

Table B-2.—Comparison of grades for participating 5th grade students in Bethlehem

Item	T (n=27)	C (n=25)	Sig
Reading			
Reading	2.85	2.84	.95
Writing	2.85	2.60	.19
Mathematics	3.08	2.64	.10
Science	3.19	3.08	.55
Social studies	3.30	3.32	.91

NOTE: Grades are presented in their original scale.

SOURCE: Student report cards

Table B-3.—Comparison of grades for participating 5th grade students in Harrisburg

Item	T (n=43)	C (n=45)	Sig
Reading			
Shows an interest in reading	2.66	2.63	.80
Selects a variety of texts	2.64	2.53	.42
Writes in response to what is read^	2.48	2.40	.61
Applies comprehension strategies^	2.34	2.38	.81
Maintains a reading log^	2.52	2.29	.17
Reads independently for an appropriate period of time	2.52	2.37	.36
Builds a reading vocabulary by identifying and using new words	2.41	2.33	.47
Reads fluently with expression	2.41	2.40	.95
States preferences when selecting text (authors, series, poetry, fiction, informational)	2.41	2.45	.77
Demonstrates an understanding of fiction and informational texts	2.57	2.50	.61
Writing			
Maintains a personal writing collection	2.55	2.55	.98
Writes daily for increasing periods of time	2.41	2.43	.93
Organizes thoughts in writing	2.32	2.30	.91
Revises writing to improve word choice and focus	2.09	2.08	.92
Analyzes characteristics of quality writing	2.11	2.05	.67
Uses other texts as models for writing	2.05	2.15	.53
Writes appropriately in response to prompts	2.39	2.30	.59
Delivers effective oral presentations	2.38	2.38	.98
Expresses thoughts clearly	2.43	2.38	.71
Listens attentively	2.50	2.31	.25
Participates in small and large group discussions	2.55	2.50	.77
Responds appropriately to questions	2.59	2.45	.34
Follows oral directions	2.61	2.38	.14
Mathematics	3.09	3.24	.52
Science	3.73	3.70	.90
Social studies	3.65	3.59	.80

NOTE: Grades are presented in their original scale.

SOURCE: Student report cards

Table B-4.—Comparison of grades for participating 5th grade students in York

Item	T (n=39)	C (n=41)	Sig
Reading strategies			
Identifies purposes and types of texts	2.65	2.73	.61
Uses strategies for reading new words	2.71	2.80	.65
Demonstrates comprehension skills	2.67	2.61	.75
Chooses to read independently	2.77	2.79	.92
Identifies characters, settings, problems and solution/endings	2.68	2.67	.94
Uses ideas from texts to make personal connections	2.61	2.67	.74
Writing strategies			
Writes to focused topics	2.84	2.71	.45
Uses a variety of word choice	2.39	2.43	.81
Uses a variety of sentence structure	2.40	2.49	.61
Uses capitalization and punctuation and proper grammar	2.41	2.47	.72
Writes multi-paragraph narrative pieces	2.57	2.49	.68
Writes multi-paragraph information pieces	2.59	2.58	.95
Writes multi-paragraph persuasive pieces	2.31	2.28	.87
Writes neatly and legibly	3.00	2.67	.06
Applies spelling strategies	2.71	2.67	.80
Listening & speaking strategies			
Listens attentively	2.71	2.65	.74
Follows oral instructions	2.84	2.82	.91
Shares ideas and information orally	2.96	2.94	.91
Communicates in complete sentences	3.00	2.96	.81
Responds to questions	2.94	3.02	.62
Speaks clearly with volume	2.84	2.98	.42
Assembles numbers in expanded form	3.02	2.70	.12
Computes in addition up to: 1 2 3 4 digits	3.21	3.00	.25
Computes in subtraction to: 1 2 3 4 digits	3.06	2.85	.29
Computes in multiplication to: 1 2 3 4 digits	2.57	2.51	.77
Computes in division to: 1 2 3 4 digits	2.64	2.52	.58
Adds and subtracts fractions	2.52	2.27	.25
Adds and subtracts decimals	2.78	2.62	.43
Measures objects using customary systems: linear, volume, weight and area	2.45	2.55	.65
Measures objects using metric system: linear, volume, weight and area	2.40	2.47	.77
Identifies the properties of plane and solid figures	2.60	2.53	.72
Makes predictions and estimations	2.80	2.69	.60
Gathers and organizes data on graphs	2.82	2.57	.24
Identifies the difference among: right, acute, obtuse, and straight angles	2.98	2.62	.22
Uses and explains strategies to solve problems: mental computation and calculators	2.60	2.51	.64
Recognizes, describes, extends, and creates number patterns	2.91	2.81	.53
Identifies the elements of scientific inquiry	2.77	2.79	.92
Recognizes similarities and differences among living things	2.90	2.80	.66
Recognizes the basic structure and properties of matter	3.00	3.06	.85
Recognizes basic landforms and processes that affect the earth	2.89	2.77	.51
Uses basic computer communication systems	3.05	3.08	.84

Table B-4.—Comparison of grades for participating 5th grade students in York—continued

Item	T (n=39)	C (n=41)	Sig
Identifies the basic principles of government	2.86	2.82	.87
Describes the basic principles of economics	2.55	3.09	.04*
Identifies and uses basic geographic tools: maps, globes, diagrams and photographs	2.90	3.00	.56
Identifies and locates places	2.78	2.79	.92
Identifies the characteristics of different cultures	2.76	2.97	.35
Develops and explains historical time lines	2.74	2.88	.47

NOTE: Grades are presented in their original scale.

SOURCE: Student report cards

APPENDIX C: HOUSEHOLD RECRUITMENT SURVEY

eSPARC Initial Household Survey [April 2004]

Hello, my name is [INTERVIEWER'S NAME], and I am calling on behalf of the [INSERT NAME OF SCHOOL DISTRICT]. May I speak to a parent of [INSERT CHILD'S NAME]?

YES	1	[SKIP TO INTRO]
NO [NOT AVAILABLE]	2	[SET CB APPT]
NO [CHILD DOES NOT LIVE WITH PARENTS]	3	[GO TO Q1]

1. May I speak to the person most knowledgeable about [CHILD'S] education?

YES	1	[SKIP TO INTRO]
NO [NOT AVAILABLE]	2	[SET CB APPT]

INTRO PARAGRAPH

[My name is {INTERVIEWER'S NAME}. I am calling on behalf of the {INSERT NAME OF SCHOOL DISTRICT}.] We are conducting a study about children's educational experiences and the use of technology at home. We'd like to ask you some questions about [INSERT NAME OF CHILD], who attends [INSERT NAME OF SCHOOL]. Your participation is very important and will help to benefit future educational policies in the state and in the nation. Your responses will be kept confidential. The interview is estimated to take about 8 minutes.

2. Just to confirm, is [CHILD] attending 4th grade at [SCHOOL NAME] this year?

YES	1	
NO	2	
[SPECIFY] School: _____		[TERMINATE]
Grade level: _____		

3. Record gender. [IF NECESSARY ASK:] Is [CHILD] male or female?

MALE	1
FEMALE	2

4. What is your relationship to [CHILD]?

MOTHER [BIRTH/ADOPTIVE/STEP/FOSTER]	1
FATHER [BIRTH/ADOPTIVE/STEP/FOSTER]	2
GRANDPARENT	3
AUNT/UNCLE	4
OTHER RELATIVE	5
NONRELATIVE	6

5. Now I am going to ask some questions about computer use in your household. Do you have a computer or laptop in working condition in your household?

YES	1	[GO TO SECTION A]
NO	2	[GO TO SECTION B]

SECTION A: FOR FAMILIES WITH COMPUTERS

6. What type of computer do you have? Is it…

An IBM or windows-based PC,	1	
A Macintosh, or	2	
Some other type of computer?	3	
DON'T KNOW	8	

7. Do you have access to the Internet at home?

YES	1	
NO	2	[SKIP TO Q9]

8. How are you connected to the Internet? Is it…

A regular telephone line,	1	
A high-speed telephone line [i.e., ISDN OR DSL]	2	
A cable service line, or	3	
A Web TV line?	4	
DON'T KNOW	8	

9. In a typical week, how many days does [CHILD] use the computer at home? Would you say…

1 to 2 days,	1	
3 to 4 days,	2	
5 or more days, or	3	
Not at all?	4	[SKIP TO Q13]
DON'T KNOW	8	[SKIP TO Q13]

10. In a typical day when [CHILD] uses the computer at home, about how long does [CHILD] use it?

_____	HOURS	1
	MINUTES	2
	DON'T KNOW	8

If the answer to question 7 was "NO" (no Internet access at home), then for question 11 only ask 11a and 11b, and *do not ask 11c and 11d*.

11. Does [CHILD] use the home computer for any of the following activities for school-related work? How about…

		YES	NO	DK
a.	Word processing,	1	2	8
b.	Educational software	1	2	8
c	The Internet or World Wide Web, or	1	2	8
d.	Email or instant messaging?	1	2	8

If the answer to question 7 was "NO" (no Internet access at home), then for question 12 only ask 12a and 12b, and *do not ask 12c and 12d*.

12. Does [CHILD] use the home computer for any of the following activities for non-school-related work? How about…

		YES	NO	DK
a.	Word processing,	1	2	8
b.	Games,	1	2	8
c.	The Internet or World Wide Web, or	1	2	8
d.	Email or instant messaging?	1	2	8

13. How important do you think computers are for [CHILD'S] education? Would you say…

Very important,	1	
Somewhat important,	2	
Not very important, or	3	
Not important at all?	4	
DON'T KNOW	8	

For the next few questions, I'd like you to think about <u>your</u> computer usage.

14. How would you characterize your ability to use computers? Would you say that your skills are…

Advanced,	1	
Average,	2	
Basic, or	3	
No skills at all?	4	[SKIP TO BOX BELOW]

15. In a typical week, how many days do you use computers? Would you say…

1 to 2 days,	1	
3 to 4 days,	2	
5 or more days, or	3	
Not at all?	4	[SKIP TO BOX BELOW]
DON'T KNOW	8	[SKIP TO BOX BELOW]

16. In a typical day when you use computers, about how long do you use them?

_____	HOURS	1
	MINUTES	2
	DON'T KNOW	8

IF Q4 = 3-6 (RESPONDENT NOT CHILD'S MOTHER OR FATHER), CHECK THIS BOX ☐ AND SKIP TO Q21

17. Is [CHILD'S] [father/mother] living in the household?

YES	1	
NO	2	[SKIP TO Q21]
REFUSED	7	[SKIP TO Q21]

Now I have some questions about [CHILD'S] [father's/mother's] use of computers.

18. How would you characterize [CHILD'S] [father's/mother's] ability to use computers? Would you say [his/her] skills are…

Advanced,	1	
Average,	2	
Basic, or	3	
No skills at all?	4	[SKIP TO Q21]
DON'T KNOW	8	[SKIP TO Q21]

19. In a typical week, how many days does [CHILD'S] [father/mother] use computers? Would you say…

1 to 2 days,	1	
3 to 4 days,	2	
5 or more days, or	3	
Not at all	4	[SKIP TO Q21]
DON'T KNOW	8	[SKIP TO Q21]

20. In a typical day, when [CHILD'S] [father/mother] uses computers, about how long does [he/she] use them?

_____	HOURS	1
	MINUTES	2
	DON'T KNOW	8

21. Has anybody in the household installed any educational software on your home computer for [CHILD]?

YES	1
NO	2
DON'T KNOW	8

Now I have some questions about [CHILD'S] education.

22. How would you describe [CHILD'S] grades at school? Would you say…

Mostly A's,	1
Mostly B's,	2
Mostly C's, or	3
Mostly D's or lower?	4
REFUSED	7
DON'T KNOW	8

23. Is [CHILD] currently enrolled in any of the following programs?

		YES	NO	DK
a.	Honors, gifted, or advanced placement classes?	1	2	8
b.	English as a second language program?	1	2	8
c.	Special education or special needs classes?	1	2	8

24. On an average school day, about how long does [CHILD] spend on homework?

_____ HOURS 1
MINUTES 2
DON'T KNOW 8

25. In a typical week, how many days do you {and [CHILD'S] [father/mother]} help with [his/her] homework? Would you say…

1 to 2 days, ... 1
3 to 4 days, ... 2
5 or more days, or 3
Not at all? 4
DON'T KNOW 8

26. How far do you expect [CHILD] to go in [his/her] education? Would you say…

Less than high school, ... 1
Finish high school or its equivalent, ... 2
Graduate from a two-year college, ... 3
Graduate from a four-year college, or 4
Obtain a graduate degree? 5
DON'T KNOW 8

27. Since the beginning of this school year, have you {or [CHILD'S] [father/mother]}…

		YES	NO	DK
a.	Gone to a regularly scheduled parent-teacher meeting with [CHILD'S] teacher?	1	2	8
b.	Attended a school or class event, such as a play, sports event, or science fair because of [CHILD]?	1	2	8
c.	Served as a volunteer at the school or in the classroom?	1	2	8
d.	Participated in fundraising for the school?	1	2	8

28. How do you feel about the education [CHILD] received at [his/her] school this year? Would you say that you are…

Satisfied 1
Neutral, or 2
Dissatisfied? 3
DON'T KNOW 8

Finally, I am going to ask a few questions about your household.

29. Is [CHILD]...

White, ... 1
African American, ... 2
Hispanic/Latino, ... 3
American Indian or Alaska Native, ... 4
Asian or Pacific Islander, or 5
Some other race? 6
REFUSED 7

30. What language does [CHILD] speak most at home?

ENGLISH	1
SPANISH	2
ANOTHER LANGUAGE	3
ENGLISH AND SPANISH/ANOTHER LANGUAGE EQUALLY	4

31. Since the beginning of this school year, has [CHILD] received free or reduced-price lunch at school?

YES	1
NO	2
DON'T KNOW	8

32. What is the highest level of education you completed?

LESS THAN A HIGH SCHOOL DIPLOMA	1
HIGH SCHOOL DIPLOMA/EQUIVALENT	2
SOME COLLEGE/VOCATIONAL/ASSOCIATE'S DEGREE	3
BACHELOR'S DEGREE	4
GRADUATE OR PROFESSIONAL DEGREE	5
REFUSED	7

33. Which of the categories below best describes your current employment status? Are you…

Employed [FULL-TIME, PART-TIME OR SELF-EMPLOYED],	1
Not employed,	2
Retired,	3
Disabled, or	4
Some other status?	5
REFUSED	7

IF Q17 = 2 (CHILD'S OTHER PARENT NOT LIVING IN HOUSEHOLD), CHECK THIS BOX ☐ AND SKIP TO Q36.

34. What is the highest level of education [CHILD'S] [father/mother] completed?

LESS THAN A HIGH SCHOOL DIPLOMA	1
HIGH SCHOOL DIPLOMA/EQUIVALENT	2
SOME COLLEGE/VOCATIONAL/ASSOCIATE'S DEGREE	3
BACHELOR'S DEGREE	4
GRADUATE OR PROFESSIONAL DEGREE	5
REFUSED	7

35. Which of the following categories best describes [CHILD'S] [father's/mother's] current employment status? Is [he/she] …

Employed [FULL-TIME, PART-TIME OR SELF-EMPLOYED],	1
Not employed,	2
Retired,	3
Disabled, or	4
Some other status?	5
REFUSED	7

36. In studies like this, households are sometimes grouped according to income. What was the total income of all persons in your household over the past year? Would you say. . .

15,000 or less,	1
15,001 to 30,000,	2
30,001 to 45,000,	3
45,001 to 60,000,	4
60,001 to 75,000, or	5
Over 75,000?	6
REFUSED	7
DON'T KNOW	8

Thank you for your time and responses.

SECTION B: FOR FAMILIES WITHOUT COMPUTERS

6. What would you say is the main reason you decided not to have a computer at home? [CIRCLE ONLY ONE RESPONSE]

DON'T WANT IT	1	
DON'T NEED IT	2	
TOO EXPENSIVE	3	
DON'T KNOW HOW TO USE IT	4	
CAN USE ONE SOMEWHERE ELSE	5	
Other	6	
[SPECIFY]_____		
DON'T KNOW	8	

7. Are we speaking on your regular telephone line at home?

YES	1	[SKIP TO Q9]
NO	2	

8. Do you have a regular telephone line at home?

YES	1	
NO	2	

9. Does [CHILD] use computers outside of school?

YES	1	
NO	2	[SKIP TO Q11]
DON'T KNOW	8	[SKIP TO Q11]

10. Where does [CHILD] use computers outside of school?

FRIEND'S OR RELATIVE'S HOME	1	
LIBRARY	2	
COMMUNITY CENTER	3	
AFTER-SCHOOL PROGRAM	4	
OTHER	5	
[SPECIFY]_____		
DON'T KNOW	8	

11. How important do you think computers are for [CHILD'S] education? Would you say…

Very important,	1
Somewhat important,	2
Not very important, or	3
Not important at all?	4
DON'T KNOW	8

For the next few questions, I'd like you to think about your computer usage.

12. How would you characterize your ability to use computers? Would you say your skills are…

Advanced,	1	
Average,	2	
Basic, or	3	
No skills at all?	4	[SKIP TO BOX BELOW]
DON'T KNOW	8	[SKIP TO BOX BELOW]

13. In a typical week, how many days do you use computers? Would you say…

1 to 2 days,	1	
3 to 4 days,	2	
5 or more days, or	3	
Not at all?	4	[SKIP TO BOX BELOW]

14. In a typical day when you use computers, about how long do you use them?

_____	HOURS	1
	MINUTES	2
	DON'T KNOW	8

IF Q4 = 3-6 (RESPONDENT NOT CHILD'S MOTHER OR FATHER), CHECK THIS BOX ☐ AND SKIP TO Q19

15. Is [CHILD'S] [father/mother] living in the household?

YES	1	
NO.	2	[SKIP TO Q19]
REFUSED	7	[SKIP TO Q19]

Now I have some questions about [CHILD'S] [father's/mother's] use of computers.

16. How would you characterize [CHILD'S] [father's/mother's] ability to use computers? Would you say his/her skills are…

Advanced,	1	
Average,	2	
Basic, or	3	
No skills at all?	4	[SKIP TO Q19]
DON'T KNOW	8	[SKIP TO Q19]

17. In a typical week, how many days does [CHILD'S] [father/mother] use computers? Would you say…

1 to 2 days,	1	
3 to 4 days,	2	
5 or more days, or	3	
Not at all?	4	[SKIP TO Q19]
DON'T KNOW	8	[SKIP TO Q19]

18. In a typical day when [CHILD'S] [father/mother] uses computers, about how long does [he/she] use them?

_____	HOURS	1
	MINUTES	2
	DON'T KNOW	8

Now I have some questions about [CHILD'S] education.

19. How would you describe [CHILD'S] grades at school? Would you say…

Mostly A's,	1
Mostly B's,	2
Mostly C's, or	3
Mostly D's or lower?	4
REFUSED	7
DON'T KNOW	8

20. Is [CHILD] currently enrolled in any of the following programs?

		YES	NO	DK
a.	Honors, gifted, or advanced placement classes?	1	2	8
b.	English as a second language program?	1	2	8
c.	Special education or special needs classes?	1	2	8

21. On an average school day, about how long does [CHILD] spend on homework?

_____	HOURS	1
	MINUTES	2
	DON'T KNOW	8

22. In a typical week, how many days do you {and [CHILD'S] [father/mother]} help with [his/her] homework? Would you say…

1 to 2 days,	1
3 to 4 days,	2
5 or more days, or	3
Not at all?	4
DON'T KNOW	8

23. How far do you expect [CHILD] to go in [his/her] education? Would you say…

Less than high school,	1
Finish high school or its equivalent,	2
Graduate from a two-year college,	3
Graduate from a four-year college, or	4
Obtain a graduate degree?	5
DON'T KNOW	8

24. Since the beginning of this school year, have you {or [CHILD'S] [father/mother]}…

		YES	NO	DK
a.	Gone to a regularly scheduled parent-teacher meeting with [CHILD'S] teacher?	1	2	8
b.	Attended a school or class event, such as a play, sports event, or science fair because of [CHILD]?	1	2	8
c.	Served as a volunteer at the school or in the classroom?	1	2	8
d.	Participated in fundraising for the school?	1	2	8

25. How do you feel about the education [CHILD] received at [his/her] school this year? Would you say that you are…

Satisfied	1
Neutral, or	2
Dissatisfied?	3
DON'T KNOW	8

26. Finally, I am going to ask a few questions about your household. Is [CHILD]...

White,	1
African American,	2
Hispanic/Latino,	3
American Indian or Alaska Native,	4
Asian or Pacific Islander, or	5
Some other race?	6
REFUSED	7

27. What language does [CHILD] speak most at home?

ENGLISH	1
SPANISH	2
ANOTHER LANGUAGE	3
ENGLISH AND SPANISH/ANOTHER LANGUAGE EQUALLY	4

28. Since the beginning of this school year, has [CHILD] received free or reduced-price lunch at school?

YES	1
NO	2
DON'T KNOW	8

29. What is the highest level of education you completed?

LESS THAN A HIGH SCHOOL DIPLOMA	1
HIGH SCHOOL DIPLOMA/EQUIVALENT	2
SOME COLLEGE/VOCATIONAL/ASSOCIATE'S DEGREE	3
BACHELOR'S DEGREE	4
GRADUATE OR PROFESSIONAL DEGREE	5
REFUSED	7

30. Which of the following categories best describes your current employment status? Are you...

Employed [FULL-TIME, PART-TIME OR SELF-EMPLOYED],	1
Not employed,	2
Retired,	3
Disabled, or	4
Some other status?	5
REFUSED	7

IF Q15 = 2 (CHILD'S OTHER PARENT NOT LIVING IN HOUSEHOLD), CHECK THIS BOX ☐ AND SKIP TO Q33.

31. What is the highest level of education [CHILD'S] [father/mother] completed?

LESS THAN A HIGH SCHOOL DIPLOMA	1
HIGH SCHOOL DIPLOMA/EQUIVALENT	2
SOME COLLEGE/VOCATIONAL/ASSOCIATE'S DEGREE	3
BACHELOR'S DEGREE	4
GRADUATE OR PROFESSIONAL DEGREE	5
REFUSED	7

32. Which of the following categories best describes [CHILD'S] [father's/mother's] current employment status? Is [he/she]…

Employed [FULL-TIME, PART-TIME OR SELF-EMPLOYED],	1
Not employed,	2
Retired,	3
Disabled, or	4
Some other status?	5
REFUSED	7

33. Do you currently own your home, rent your home, or have some other living arrangement?

OWN HOME	1
RENT HOME	2
SOME OTHER ARRANGEMENT	3
[SPECIFY] _____	

34. How long have you lived at your current residence?

_____	YEARS	1
	MONTHS	2

35. In studies like this, households are sometimes grouped according to income. What was the total income of all persons in your household over the past year? Would you say…

15,000 or less,	1
15,001 to 30,000,	2
30,001 to 45,000,	3
45,001 to 60,000,	4
60,001 to 75,000, or	5
Over 75,000?	6
REFUSED	7
DON'T KNOW	8

36. Do you expect [CHILD] to stay at the same school for the next school year?

YES	1
NO	2
DON'T KNOW	8

37. In case we want to follow up on this call, is this the best number to reach you at?

YES	1
NO	2
[SPECIFY] _____	

38. When is the best time of the day to reach you?

_____

39. If we call back, we'd like to speak with you again. Could you tell us your first name?

_____

Thank you for your time and responses.

APPENDIX D: POST-INTERVENTION PARENT SURVEY

eSPARC Spring Parent Survey
TREATMENT GROUP

INTRODUCTION

I'm calling to conduct a survey regarding the computer you received through the eSPARC program. I would like to ask some general questions about [CHILD], you, and computers. The interview should take about 30 minutes. If there are any questions you do not want to answer, please let me know.

ON SCHOOL ACTIVITIES

1. The first set of questions is about [CHILD'S] education and schoolwork. How often does [CHILD] do homework, either at home, at an after-school program, or somewhere else outside of school? Would you say…

1 to 2 days a week	1	
3 to 4 days a week,	2	
5 or more days a week, or	3	
Not at all?	4	(SKIP TO Q6)
CHILD DOES NOT HAVE HOMEWORK	5	(SKIP TO Q6)
REFUSED	7	(SKIP TO Q6)
DON'T KNOW	8	(SKIP TO Q6)

2. On an average school night when [CHILD] does homework outside of school, about how many hours does (he/she) spend on homework?

___ ___ Hours	REFUSED	97
	DON'T KNOW	98

3. In a typical week, about how often do you or another adult in the household review [CHILD'S] homework to make sure it is done? Would you say…

1 to 2 days a week	1
3 to 4 days a week,	2
5 or more days a week, or	3
Not at all?	4
REFUSED	7
DON'T KNOW	8

4. In a typical week, how many days do you or another adult in the household help with [CHILD's] **math** homework? Would you say…

1 to 2 days a week	1
3 to 4 days a week,	2
5 or more days a week, or	3
Not at all?	4
DOES NOT HAVE HOMEWORK IN THIS SUBJECT	5
REFUSED	7
DON'T KNOW	8

5. In a typical week, how many days do you or another adult in the household help with [CHILD's] **reading, writing, or spelling** homework? Would you say…

1 to 2 days a week	1
3 to 4 days a week,	2
5 or more days a week, or	3
Not at all?	4
DOES NOT HAVE HOMEWORK IN THIS SUBJECT	5
REFUSED	7
DON'T KNOW	8

6. In a typical week, how often do you or another adult in the household talk with [CHILD] about (his/her) experiences at school? Would you say…

Every day	1
Most days,	2
Some days, or	3
Rarely?	4
REFUSED	7
DON'T KNOW	8

7. In a typical week, how often do you or another adult in the household talk with [CHILD] about [CHILD'S] personal interests or hobbies? Would you say…

Every day	1
Most days,	2
Some days, or	3
Rarely?	4
REFUSED	7
DON'T KNOW	8

8. Overall, would you say [CHILD] is **more** interested in school this school year than last school year, **less** interested in school this school year than last school year, or **about the same**?

More interested	1
Less interested	2
About the same	3
REFUSED	7
DON'T KNOW	8

9. In the last week, how many times did you or another adult in the household talk with [CHILD] about something that [CHILD] did or saw on a computer? Would you say…

1 to 2 times,	1
3 to 4 times,	2
5 or more times, or	3
Not at all?	4
REFUSED	7
DON'T KNOW	8

10. In the last week, how many times did you or another adult in the household ask [CHILD] to find information for you on the Internet using a computer? Would you say…

1 to 2 times,	1
3 to 4 times,	2
5 or more times, or	3
Not at all?	4
REFUSED	7
DON'T KNOW	8

11. How far do you expect [CHILD] to go in (his/her) education? Would you say…

Less than high school,	1
Finish high school or its equivalent,	2
Graduate from a two-year college,	3
Graduate from a four-year college, or	4
Obtain a graduate degree, such as a Master's degree or Doctorate?	5
REFUSED	7
DON'T KNOW	8

12. During the *current* school year, did you or [CHILD'S] (mother/father)…

		YES	NO	DOES NOT APPLY	RF	DK
a.	Ever go to a regularly scheduled parent-teacher meeting with [CHILD'S] teacher?	1	2	3	7	8
b.	Attend a PTA meeting?	1	2	3	7	8
c.	Attend back to school night or open house at [CHILD's] school?	1	2	3	7	8
d.	Chaperone a school field trip for [CHILD's] class?	1	2	3	7	8
e.	Attend a school or class event, such as a play or science fair?	1	2	3	7	8
f.	Volunteer at the school or in the classroom?	1	2	3	7	8
g.	Participate in fundraising for [CHILD'S] school?	1	2	3	7	8
h.	Go to a sports event at [CHILD'S] school?	1	2	3	7	8
i.	Call [CHILD's] teacher to talk about (his/her) grades or behavior?	1	2	3	7	8
j.	Use email to communicate with [CHILD's] teachers?	1	2	3	7	8
k.	Access [CHILD's] school's website using the Internet?	1	2	3	7	8
l.	Access another education-related website?	1	2	3	7	8

ABOUT THE RESPONDENT

13. To help us learn how families can use the eSPARC computers, it's important to know what other experiences people in the household have had with computers. The next set of questions is about you. I'm going to read a list of places that have computers and I would like you to tell me if you have used computers at any of these places in the last month. **In the last month**, have you used computers…

IF RESPONDENT HAS NEVER USED COMPUTERS, CHECK BOX ☐ AND SKIP TO Q24.

	YES	NO	RF	DK
a. At a public library?	1	2	7	8
b. At a school or university?	1	2	7	8
c. At a community or recreation center?	1	2	7	8
d. At work?	1	2	7	8
e. At home?	1	2	7	8
f. At some other location?	1	2	7	8

[SPECIFY]_____

If Q13d = 1 (used computer at work in the last month) ask Q14. Else, go to Q16.

14. In the last week, about how many days did you use a computer at work? Would you say…

1 to 2 days,	1	
3 to 4 days,	2	
5 or more days, or.	3	
Not at all?	4	(SKIP TO Q16)
REFUSED	7	(SKIP TO Q16)
DON'T KNOW	8	(SKIP TO Q16)

15. In the last week, on the days when you used computers at work, about how long did you use them? Would you say…

Less than 1 hour per day,	1
Between 1 to 2 hours per day, or	2
More than 2 hours per day?	3
REFUSED	7
DON'T KNOW	8

16. In the past year, did you…

	YES	NO	RF	DK
a. Take any classes about computers?	1	2	7	8
b. Purchase any books about how to use computers?	1	2	7	8
c. Purchase any software to help you use computers?	1	2	7	8

17. I'm going to read a list of things that you may or may not know how to do with a computer. For each one, please tell me if you can do it by yourself, if you need help doing it, or if you have never done it before. If you are not sure whether you have done it, you can tell me that. How about… (*Can you do this by yourself, need help doing this, or have never done this before?*)

	Can do this by yourself	Need help to do this	Have never done this	NOT SURE
a. Print a file	1	2	3	4
b. Save a file	1	2	3	4
c. Erase or delete a file you don't need anymore	1	2	3	4
d. Install software on a computer	1	2	3	4
e. Select and change fonts in a word processing document	1	2	3	4
f. Create a bulleted list in a word processing document	1	2	3	4
g. Make a bookmark for a web page so you can easily go back to it	1	2	3	4
h. Attach a document to an email message	1	2	3	4
i. Use help menus to find answers to questions	1	2	3	4

18. How often do you do each of the following things on computers? Please say whether you do it several times a week, several times a month, or less than once a month. How about… (*Would you say you do it several times a week, several times a month, or less than once a month?*)

[FOR EACH Q18A-E RESPONSE, ASK: Would you say your skills at this are advanced, average, or beginner?]

	A			B				
	Several times a week	Several times a month	Less than once a month	Advanced	Average	Be-ginner	RF	DK
a. Typing or using a word processor? ..	1	2	3	1	2	3	7	8
b. Making or using spreadsheets?.....	1	2	3	1	2	3	7	8
c. Preparing presentations?.....	1	2	3	1	2	3	7	8
d. Searching the Internet for information?.....	1	2	3	1	2	3	7	8
e. Using email?	1	2	3	1	2	3	7	8

19. Do you ever use the Internet at any of the places where you use computers?

YES	1	
NO	2	(SKIP TO Q21)
REFUSED	7	(SKIP TO Q21)
DON'T KNOW	8	(SKIP TO Q21)

20. How often do you use the Internet to… (*Would you say several times a week, several times a month, or less than once a month?*)

	Several times a week	Several times a month	Less than once a month	RF	DK
a. Get information about things related to work?	1	2	3	7	8
b. Play games or listen to music?	1	2	3	7	8
c. Buy or trade things such as books, clothing or music?	1	2	3	7	8
d. Use email or chat rooms?	1	2	3	7	8
e. Get information about something that's hard to talk about with other people?	1	2	3	7	8
f. Get news, sports, or weather information?	1	2	3	7	8
g. Get information about your hobbies?	1	2	3	7	8
h. Help [CHILD] with school work?	1	2	3	7	8
i. Help [CHILD] find information about an interest or hobby?	1	2	3	7	8
j. Visit the eSPARC website?	1	2	3	7	8

21. Next I am going to read several statements about computers. For each one, please tell me if you agree or disagree. (FOR EACH AGREE RESPONSE, ASK WHETHER RESPONDENT STRONGLY AGREES OR SOMEWHAT AGREES. FOR EACH DISAGREE RESPONSE, ASK WHETHER RESPONDENT STRONGLY DISAGREES OR SOMEWHAT DISAGREES)

	Agree	Disagree	Strongly agree	Somewhat agree	Strongly disagree	Somewhat disagree
a. I am good at using computers	1	2	1	2	1	2
b. I like to surf the Internet	1	2	1	2	1	2
c. I feel frustrated when I use computers	1	2	1	2	1	2
d. I want to spend more time using computers	1	2	1	2	1	2
e. Computer skills are important for today's job market	1	2	1	2	1	2
f. Computers help children do better in school	1	2	1	2	1	2

22. These next questions are about your use of the eSPARC computer. In the last week, how many days did you use the eSPARC computer? Would you say…

1 to 2 days,	1	
3 to 4 days,	2	
5 or more days, or	3	
Not at all?	4	(SKIP TO Q24)
REFUSED	7	(SKIP TO Q24)
DON'T KNOW	8	(SKIP TO Q24)

23. On the days when you used the eSPARC computer in the last week, about how long did you use it? Would you say…

Less than 1 hour,	1
Between 1 to 2 hours, or	2
More than 2 hours a day?	3
REFUSED	7
DON'T KNOW	8

INFORMATION ON OTHER PARENT

24. This next set of questions is about [CHILD'S] (mother/father). Is it okay if I ask you some questions about [CHILD'S] (mother/father)?

YES	1	
NO	2	(SKIP TO Q35)
RESPONDENT HAS NO KNOWLEDGE OF OTHER PARENT	3	(SKIP TO Q35)
PARENT NO LONGER LIVING	4	(SKIP TO Q35)
REFUSED	7	(SKIP TO Q35)
DON'T KNOW	8	(SKIP TO Q35)

25. Does [CHILD'S] (mother/father) live in your household?

YES	1	
NO	2	(SKIP TO Q28)
REFUSED	7	(SKIP TO Q35)
DON'T KNOW	8	(SKIP TO Q35)

26. In the last week, how many days did [CHILD'S] (mother/father) use the eSPARC computer? Would you say…

1 to 2 days,	1	
3 to 4 days,	2	
5 or more days, or	3	
Not at all?	4	(SKIP TO Q30)
REFUSED	7	(SKIP TO Q30)
DON'T KNOW	8	(SKIP TO Q30)

27. On the days when (he/she) used the eSPARC computer in the last week, about how long did (he/she) use it?

Less than 1 hour,	1	(SKIP TO Q30)
Between 1 to 2 hours, or	2	(SKIP TO Q30)
More than 2 hours a day?	3	(SKIP TO Q30)
REFUSED	7	(SKIP TO Q30)
DON'T KNOW	8	(SKIP TO Q30)

28. Does (CHILD) spend at least 10 hours per week at the home of [his/her] other parent?

YES	1	
NO	2	(SKIP TO Q30)
REFUSED	7	(SKIP TO Q30)
DON'T KNOW	8	(SKIP TO Q30)

29. When (CHILD) stays with [his/her] other parent, does [he/she] have access to a computer there?

YES	1
NO	2
REFUSED	7
DON'T KNOW	8

30. In the last month, has [CHILD's] (mother/father) used computers at any of the following places? If you do not know, you can tell me that.

IF OTHER PARENT HAS NEVER USED COMPUTERS, CHECK BOX ☐ AND SKIP TO QUESTION 35.

		YES	NO	RF	DK
a.	At a public library?	1	2	7	8
b.	At a school or university?	1	2	7	8
c.	At a community or recreation center?	1	2	7	8
d.	At work?	1	2	7	8
e.	Some other place?	1	2	7	8

If Q30d=1 (used computer at work in the last month) ask Q31. Else, go to Q32.

31. In the last week, how many days did [CHILD'S] (mother/father) use computers at work? Would you say…

1 to 2 days,	1
3 to 4 days,	2
5 or more days, or	3
Not at all?	4
REFUSED	7
DON'T KNOW	8

32. Does [CHILD's] (mother/father) ever use the Internet at any of the places where (he/she) uses computers?

YES	1	
NO	2	(SKIP TO Q34)
REFUSED	7	(SKIP TO Q34)
DON'T KNOW	8	(SKIP TO Q34)

33. How often does [CHILD's] (mother/father) use the Internet to… (*Would you say (he/she) does it several times a week, several times a month, or less than once a month?*)

	Several times a week	Several times a month	Less than once a month	RF	DK
a. Get information about things related to work?	1	2	3	7	8
b. Play games or listen to music?	1	2	3	7	8
c. Buy or trade things such as books, clothing or music?	1	2	3	7	8
d. Use email or chat rooms?	1	2	3	7	8
e. Get information about something that's hard to talk about with other people?	1	2	3	7	8
f. Get news, sports, or weather information?	1	2	3	7	8
g. Get information about (his/her) hobbies?	1	2	3	7	8
h. Help [CHILD] with school work?	1	2	3	7	8
i. Help [CHILD] find information about an interest or hobby?	1	2	3	7	8
j. Visit the eSPARC website?	1	2	3	7	8

34. How would you characterize [CHILD'S] (mother's/father's) ability to use computers? Would you say (his/her) skills are advanced, average, or beginner?

Advanced	1	
Average	2	
Beginner	3	
DON'T KNOW	8	

ON THE eSPARC COMPUTER

35. This next set of questions is about your eSPARC computer. In the past month, how often have you had problems with it or the Internet service? Would you say…

Often,	1	
Sometimes, or	2	
Not at all?	3	(SKIP TO Q38)
REFUSED	7	(SKIP TO Q38)
DON'T KNOW	8	(SKIP TO Q38)

36. Please tell me if you have had any of the following problems with your eSPARC computer at any time in the past month. The first one is…

	YES	NO	HAVE NOT USED	RF	DK
a. The computer wouldn't work well or not at all	1	2	3	7	8
b. The Internet wouldn't work well or not at all	1	2	3	7	8
c. The printer wouldn't work well or not at all	1	2	3	7	8

37. Now I am going to read you a list of things people often try when they have problems using their computer or Internet service. Please tell me if you have done any of these things to solve a problem with your eSPARC computer:

	YES	NO	RF	DK
a. Restart the computer?	1	2	7	8
b. Ask [CHILD] for help?	1	2	7	8
c. Ask someone else in your family for help?	1	2	7	8
d. Ask a friend for help?	1	2	7	8
e. Call the eSPARC helpline?	1	2	7	8
f. Try to figure out the problem and solve it yourself?	1	2	7	8
g. Have you done something else to solve a problem? [SPECIFY]_____	1	2	7	8

38. Besides any software supplied by the eSPARC program, have you or another adult in the household installed any computer programs or software on your eSPARC computer?

YES	1	
NO	2	(SKIP TO Q40)
REFUSED	7	(SKIP TO Q40)
DON'T KNOW	8	(SKIP TO Q40)

39. Were any of these programs that you installed…

	YES	NO	RF	DK
a. For your work?	1	2	7	8
b. For your children's education?	1	2	7	8
c. For entertainment purposes?	1	2	7	8
d. For household management, such as tax preparation software?	1	2	7	8

40. Besides [CHILD], please tell me all of the people who now regularly use the eSPARC computer? (**CIRCLE ALL THAT APPLY**.)

a. SELF	1
b. OTHER PARENT	2
c. [CHILD'S] OLDER SISTER(S) OR BROTHER(S)	3
d. [CHILD'S] YOUNGER SISTER(S) OR BROTHER(S)	4
e. OTHER CHILDREN IN HOUSEHOLD	5
f. [CHILD'S] FRIENDS	6
g. OTHER	7
[SPECIFY]_____	
h. NO ONE BESIDES [CHILD]	8
REFUSED	97
DON'T KNOW	98

41. In the last week, have you or another adult in the household spent any time with [CHILD] using the eSPARC computer together?

YES	1
NO	2
REFUSED	7
DON'T KNOW	8

42. Did you or another adult in your household attend any of the computer training sessions offered by eSPARC?

YES	1	
NO	2	(SKIP TO Q44)
REFUSED	7	(SKIP TO Q44)
DON'T KNOW	8	(SKIP TO Q44)

43. How many computer training sessions did you or another adult in the household attend?

ONE	1	(SKIP TO Q45)
TWO TO THREE	2	(SKIP TO Q45)
FOUR OR MORE	7	(SKIP TO Q45)
DON'T KNOW	8	(SKIP TO Q45)

44. What was your main reason for deciding not to attend a computer training session offered by eSPARC?

NOT ENOUGH NOTICE	1
HAD TO WORK	2
TIME WASN'T CONVENIENT	3
DIDN'T HAVE CHILD CARE	4
TOPIC WAS NOT INTERESTING	5
TOPIC WAS NOT CLEAR	6
LOCATION WASN'T CONVENIENT	7
WAS NOT INFORMED ABOUT SESSIONS	8
OTHER	9
SPECIFY_____	
DON'T KNOW	98

45. Please tell me what you or another adult in the household have done with [CHILD] using the eSPARC computer in the last week.
[RECORD VERBATIM]

_____

_____

_____

46. What would you say is the main way in which the eSPARC computer has been helpful to [CHILD]? [RECORD VERBATIM]

_____

_____

_____

47. What would you say is the main way in which the eSPARC computer has been helpful to *others* in your household? [RECORD VERBATIM]

_____

_____

_____

48. Has the eSPARC computer created any problems for [CHILD] or others in your household?

YES	1	
NO	2	(SKIP TO Q50)
REFUSED	7	(SKIP TO Q50)
DON'T KNOW	8	(SKIP TO Q50)

49. How has the eSPARC computer created problems for [CHILD] or others in your household? [RECORD VERBATIM]

_____

_____

_____

50. For these next questions, please tell me if the eSPARC computer has had a **positive effect**, a **negative effect**, or has **not had any effect**. How about… [PROBE USING RESPONSE CATEGORIES]

	Positive effect	Negative effect	No effect	DOES NOT APPLY	RF	DK
a. [CHILD'S] interest in school?	1	2	3	4	7	8
b. [CHILD'S] interest in technology?	1	2	3	4	7	8
c. [CHILD'S] overall confidence in [his/her] abilities?	1	2	3	4	7	8
d. The quality of [CHILD'S] schoolwork?	1	2	3	4	7	8
e. [CHILD'S] interest in hobbies?	1	2	3	4	7	8
f. [CHILD'S] behavior at home?	1	2	3	4	7	8
g. Your involvement in [CHILD'S] education?	1	2	3	4	7	8
h. Your work-related skills?	1	2	3	4	7	8
i. [CHILD'S] (father's/mother's) work-related skills?	1	2	3	4	7	8
j. [CHILD'S] (father's/mother's) involvement in (his/her) education?	1	2	3	4	7	8

IF Q40 = 3 or 4, (siblings in household use the computer) ask Q50k and l. Else, go to Q51.

k. Your other (child's/children's) interest in school?	1	2	3	4	7	8
l. The quality of your other (child's/children's) schoolwork?	1	2	3	4	7	8

51. Besides the eSPARC computer, how many computers do you currently have in your household, whether they work or not?

NONE	1	(SKIP TO Q53)
ONE	2	
TWO	3	
THREE OR MORE	4	
REFUSED	7	(SKIP TO Q53)
DON'T KNOW	8	(SKIP TO Q53)

52. How many of these computers are in working condition?

NONE	1
ONE	2
TWO	3
THREE OR MORE	4
REFUSED	7
DON'T KNOW	8

53. Do you plan to buy a new computer in the near future?

YES	1
NO	2
REFUSED	7
DON'T KNOW	8

54. I have a few final questions to ask you. Is [CHILD] currently enrolled in any of the following programs?

		YES	NO	DK
a.	Honors, gifted, or advanced placement classes?	1	2	8
b.	English as a second language program?	1	2	8
c.	Special education or special needs classes?	1	2	8

55. Which of the categories below best describes your current employment status? Are you…

Employed [FULL-TIME, PART-TIME OR SELF-EMPLOYED],	1
Not employed,	2
Retired,	3
Disabled, or	4
Some other status?	5
REFUSED	7

IF Q25 = 2 (CHILD'S OTHER PARENT NOT LIVING IN HOUSEHOLD), CHECK THIS BOX ☐ AND SKIP TO Q57.

56. Which of the following categories best describes [CHILD'S] [father's/mother's] current employment status? Is [he/she] …

Employed [FULL-TIME, PART-TIME OR SELF-EMPLOYED], ...	1
Not employed, ...	2
Retired, ...	3
Disabled, or	4
Some other status?	5
REFUSED	7

57. In studies like this, households are sometimes grouped according to income. What was the total income of all persons in your household over the past year? Would you say. . .

15,000 or less, ...	1
15,001 to 30,000, ...	2
30,001 to 45,000, ...	3
45,001 to 60,000, ...	4
60,001 to 75,000, or	5
Over 75,000?	6
REFUSED	7
DON'T KNOW	8

(PLEASE VERIFY RIS)

THANK: Thank you, those are all the questions I have for you today. Thank you very much for your time and we look forward to talking to you again in May of next year.

APPENDIX E: POST-INTERVENTION STUDENT SURVEY

TREATMENT POST-SURVEY
ESPARC STUDY

1. **For each of the following sentences, answer whether you "strongly agree," "kind of agree," "kind of disagree," or "strongly disagree."**

	Strongly agree	Kind of Agree	Kind of disagree	Strongly disagree	Doesn't apply to me
a. I always work hard and try my best at school.	○	○	○	○	
b. Most things we learn in school are useful.	○	○	○	○	
c. I would rather be at school than stay at home.	○	○	○	○	
d. My teacher cares about me.	○	○	○	○	
e. I get along well with my parent(s).	○	○	○	○	
f. I get along well with my brother(s) and sister(s).	○	○	○	○	○
g. I have a lot of confidence in my self.	○	○	○	○	
h. My schoolwork is too hard.	○	○	○	○	

2. For these next items, please say whether you do it "often," "sometimes," "hardly ever, or "never."

	Often	Sometimes	Hardly ever	Never
a. Ask questions in class.	○	○	○	○
b. Pay attention in class.	○	○	○	○
c. Come to class with your homework completed.	○	○	○	○
d. Read *books* on your own that are NOT for school.	○	○	○	○
e. Ask for help from your teacher about schoolwork.	○	○	○	○
f. Share information you have found on the Internet with teachers or classmates.	○	○	○	○

3. In the last month, how often did you use computers at each of the following places?

	Almost every day	Several times a week	About once a week	Once or twice in the last month	Not at all
a. At home	○	○	○	○	○
b. At a relative's home	○	○	○	○	○
c. At a friend's home	○	○	○	○	○
d. At school	○	○	○	○	○
e. At a public library	○	○	○	○	○
f. At an after-school program	○	○	○	○	○

4. In the last month, how often did you *get help* using computers from each of the following people?

	Several times a week	About once a week	Once or twice in the last month	Not at all	Doesn't apply to me
a. A parent	○	○	○	○	
b. A teacher	○	○	○	○	
c. A brother or sister	○	○	○	○	○
d. A friend	○	○	○	○	

5. In the last month, how often did you *give* help using computers *to* each of the following people?

	Several times a week	About once a week	Once or twice in the last month	Not at all	Doesn't apply to me
a. A parent	○	○	○	○	
b. A teacher	○	○	○	○	
c. A brother or sister	○	○	○	○	○
d. A friend	○	○	○	○	

6. In the last month, how often did you use *any* computer to…

	Several times a week	About once a week	Once or twice in the last month	Not at all
a. Type up homework for school?	○	○	○	○
b. Type up something **NOT** for school?	○	○	○	○
c. Work on a spreadsheet?	○	○	○	○
d. Find information on the Internet for school?	○	○	○	○
e. Find information on the Internet that was **NOT** for school?	○	○	○	○
f. Send email messages to friends or relatives?	○	○	○	○
g. Play games?	○	○	○	○
h. Listen to or download music?	○	○	○	○
i. Go to a chat room?	○	○	○	○
j. Talk with a friend using instant messaging?	○	○	○	○
k. Download software from the Internet?	○	○	○	○

7. In the past three days, how many emails did you send on *any* computer?

○ No emails
○ 1 to 4 emails
○ 5 to 9 emails
○ 10 or more emails

8. How often do you use *any* computer…

	Often	Sometimes	Hardly ever	Not at all	Doesn't apply to me
a. With a parent?	○	○	○	○	
b. With some other adult in the household?	○	○	○	○	○
c. With a *younger* brother or sister?	○	○	○	○	○
d. With an *older* brother or sister?	○	○	○	○	○
e. With a friend?	○	○	○	○	
f. By yourself?	○	○	○	○	

9. Besides during regular school hours, about how much time do you normally spend each day doing homework?

○ Not at all
○ Less than 1 hour
○ 1 to 2 hours
○ More than 2 hours

10. About how much time do you spend doing homework or studying *on weekends*?

○ Not at all
○ Less than 1 hour
○ 1 to 2 hours
○ More than 2 hours

11. In the last month, how often did you use *any* computer for doing…

	Several times a week	About once a week	Once or twice in the last month	Not at all
a. Math homework?	○	○	○	○
b. Science homework?	○	○	○	○
c. Social studies homework?	○	○	○	○
d. Reading, writing, or spelling homework?	○	○	○	○

12. For each of the following subjects, say whether you think it is "always interesting," "usually interesting," or "usually boring" or "always boring." How about…

	Always interesting	Usually interesting	Usually boring	Always boring
a. Math?	○	○	○	○
b. Science?	○	○	○	○
c. Social studies?	○	○	○	○
d. Reading, writing, and spelling?	○	○	○	○

13. In the last month, how often did you…

	Almost every day	Several times a week	About once a week	Once or twice in the last month	Not at all
a. Watch television?	○	○	○	○	○
b. Read for fun?	○	○	○	○	○
c. Play outside with friends?	○	○	○	○	○
d. Talk with your parents about your schoolwork?	○	○	○	○	○

14. For each of the following things that you can do with computers, please say if you can do it all by yourself, if you need help to do it, or if you have never done it before. If you are not sure whether you have ever done it before, you can say that. How about…

	I can do this by myself	I need help to do this	I have never done this	I'm not sure if I have ever done this
a. Find a file when you aren't sure where it is located on a computer.	○	○	○	○
b. Print a file.	○	○	○	○
c. Save a file.	○	○	○	○
d. Rename a file.	○	○	○	○
e. Erase or delete a file you don't need anymore.	○	○	○	○
f. Type a story or report on a computer.	○	○	○	○
g. Cut and paste words or sentences from one place to another.	○	○	○	○
h. Work on a spreadsheet.	○	○	○	○
i. Search for information on the Internet.	○	○	○	○
j. Make a bookmark for a web page so you can easily go back to it.	○	○	○	○
k. Download graphics or pictures from the Internet	○	○	○	○
l. Send and read email.	○	○	○	○
m. Attach a file to an email message.	○	○	○	○

15. For each of the following sentences, say whether you "strongly agree," "kind of agree," "kind of disagree," or "strongly disagree." If you don't know or it doesn't apply to you, you can say "don't know."

	Strongly agree	Kind of agree	Kind of disagree	Strongly disagree	Don't know
a. I'm good at using computers and the Internet.	○	○	○	○	○
b. I often get frustrated when using computers.	○	○	○	○	○
c. I understand some things better when I use a computer.	○	○	○	○	○
d. Using a computer makes learning more interesting for me.	○	○	○	○	○
e. I would rather write school reports using a computer than write them by hand.	○	○	○	○	○
f. My writing is better when I use a computer than when I write by hand.	○	○	○	○	○
g. I work harder at my assignments when using a computer.	○	○	○	○	○
h. I am better than most of the kids in my class at using computers.	○	○	○	○	○
i. I think computers are boring.	○	○	○	○	○

16. Last *weekend*, about how much time total did you spend using your eSPARC computer?

- ○ Not at all
- ○ Less than 1 hour
- ○ 1 to 2 hours
- ○ 3 to 4 hours
- ○ More than 4 hours

17. During the last school week, that is Monday through Friday, how many days did you use your eSPARC computer?

- ○ Not at all
- ○ 1 or 2 days
- ○ 3 or 4 days
- ○ All 5 days

18. During the last week, on the days when you used your eSPARC computer, about how much time did you spend using it?

- ○ Not at all
- ○ Less than 1 hour per day
- ○ 1 to 2 hours per day
- ○ More than 2 hours per day

19. In the last month, how often have you had problems with your eSPARC computer?

- ○ Several times a week
- ○ About once a week
- ○ Once or twice in the last month
- ○ Never

20. Who uses your eSPARC computer the <u>most</u> in your home?

- ○ I use it the most
- ○ A parent or other adult
- ○ A brother or sister

21. For each of the following sentences, answer whether you "strongly agree," "kind of agree," "kind of disagree," or "strongly disagree."

	Strongly agree	Kind of agree	Kind of disagree	Strongly disagree	Doesn't apply to me
a. As a result of having the eSPARC computer, I feel more confident about the things I can do.	○	○	○	○	
b. As a result of having the eSPARC computer, I get along better with my parents.	○	○	○	○	
c. As a result of having the eSPARC computer, I get along better with my brother(s) or sister(s).	○	○	○	○	○
d. As a result of having the eSPARC computer, my computer skills have improved.	○	○	○	○	
e. As a result of having the eSPARC computer, I like school more.	○	○	○	○	

Open-ended Items for the Student Survey

FOR *ALL* STUDENTS

1. **Before I take your survey, please look over your answers. Were there any questions on the survey that you found confusing and/or difficult to answer?**

2. **How many of you answered that you *GOT* help in using computers from any of the following types of people in the past month?**

   - ❒ Your parents
   - ❒ Your teacher
   - ❒ Your brother or sister
   - ❒ A friend

   What type of help did you receive?

3. **How many of you answered that you *GAVE* help to any of the following types of people in the past month?**

   - ❒ Your parents
   - ❒ Your teacher
   - ❒ Your brother or sister
   - ❒ A friend

   What type of help did you provide?

4. **How many of you answered that you used computers with:**

   - ❒ Your parents?
   - ❒ With some other adult in the household?
   - ❒ Your brother or sister?

   What did you do with them on the computer—e.g., check e-mail, go to websites, play computer games?

5. **How many of you answered that you used the Internet outside of the classroom to:**

   - ❒ Find something for school *(What type of information were you looking for?)*
   - ❒ Find something NOT for school *(What type of information were you looking for?)*

6. How many of you answered that you used computers for doing homework?

What type of homework did you use the computer for—and how did you use computers to do this homework?

- ❒ Math homework?
- ❒ Science homework?
- ❒ Social studies homework?
- ❒ Reading, writing or spelling homework?

7. How many of you answered that:

- ❒ You understand some things better when you use the computer *(What types of things do you understand better?)*
- ❒ Using a computer makes learning more interesting for you *(How does using a computer make learning more interesting for you?)*

FOR ESPARC STUDENTS:

8. How many of you said that you were having problems with your eSPARC computer or the Internet?

What types of problems have you been having?

How have you been solving these problems?

9. *(IF THERE IS TIME)* Talk a bit more about what you like best about having your eSPARC computer.

APPENDIX F: PARENT FOCUS GROUP PROTOCOLS

eSPARC Focus Group Guide (January 2005)

Introduction and Meeting Guidelines:

1. Good evening and welcome. Thanks for taking the time to join our discussion about the eSPARC computer program. My name is _____, and I am from Westat, a research organization in Maryland with expertise in educational evaluations. We have been conducting the evaluation of the eSPARC program and you probably know us from the telephone surveys that you have completed as part of our study.

2. We have been asked by the Pennsylvania Department of Education to help them get some information about how parents feel about the eSPARC program. They want the information to improve the program and services they provide.

3. Just so you know, each of you was randomly selected to participate in this focus group.

4. There is no right or wrong answer to the questions we are going to ask tonight. Also, we're not asking for you to reach agreement on any of the questions we discuss tonight. We do want to know what your experience with the program has been. Most important to us is that you feel comfortable giving us your honest opinions, both good and bad, about the program.

5. If you want to follow up on something that has been said, you want to agree, or disagree, or give an example, feel free to do that. Don't feel like you have to respond to me all the time. Feel free to have a conversation with one another about these questions. We're interested in hearing from each of you. So if you're' talking a lot, I may ask you to give others a chance. And if you aren't saying much, I may call on you. Sometimes, I'll ask to go around and hear from everyone.

6. Although we will be recording the conversation tonight, everything we discuss will be strictly confidential. We record only to capture all the information and to make note taking easier. Liam will be taking notes tonight, using your first names only. But in a summary of the meeting and in communications with the Pennsylvania Department of Education, names will not be used. We ask that you treat the information you hear tonight as confidential as well.

7. There may be some things in particular that you want to make sure we discuss tonight. We are going to be asking a lot of questions about your experiences with eSPARC, but have left time at the end of the session for whatever you want to discuss. At the close of the hour, we will hand out payments and ask that you sign a receipt. You should each have a notepad, pencil.

8. Before we begin, I'd like to go around the room and ask each of you to introduce yourselves and tell us how long you have lived in the York area.

Initial Experiences with eSPARC Computer

1. I'd like to begin by asking about your eSPARC computer. Who in your family uses the eSPARC computer?

    a. What kinds of things does your 5th grade child use the computer for?
    b. What kinds of things do you use the computer for?
    c. What types of web sites have you visited on your eSPARC computer? What types of websites has your child visited?

2. How useful was the initial training that you and your child received when your eSPARC computers were handed out?

    Did you have any trouble setting up the eSPARC computer in your home?

eSPARC Training

3. Now I'd like to ask some questions about the computer and Internet training that the State of Pennsylvania is providing to the parents and 5th grade students who are participating in eSPARC.

    Two eSPARC training sessions have been provided already—one in December and one in January. Raise your hand if you **knew** about these sessions (not necessarily attended)?

    a. *(For those who knew about the training sessions)* How did you learn about the training?
    b. Who attended the training?

4. *(For those who knew about the training—but did not attend)* Was there something that kept you from attending one of these training sessions?

    (Circle frequency of responses and probe as indicated)

    a. Proximity to the holidays
    b. Not enough notice *(How much notice needed?)*
    c. Had to work *(What time would be more convenient?)*
    d. Location wasn't convenient *(What location would be more convenient?)*
    e. Time wasn't convenient *(What time would be more convenient?)*
    f. Didn't have child care
    g. Topic was not clear
    h. Topic was not of interest *(What topics would be of interest?)*

5. Now, I'd like you to use the notepad we gave you, and make two short lists –one with 1-3 things that you would like your 5th grade child to learn about during a future eSPARC training session.

    (For example, are there things you think your child could learn that would make it easier for them to use computers for schoolwork? Think about subjects he/she struggles with, as well as things he/she has asked you for help about in the past; maybe even things that are related to doing a project or writing a paper)

6. On the other list, write down 1-3 things that you would like to learn about during a future eSPARC training session.

   (For example, are there computer-related skills you'd like to learn for your job, or specific things to make yourself more marketable, are you interested in learning how to safely purchase items online...Things you've heard about that others use the Internet for and you'd like to learn)

7. If [*the most requested topics among the parents*] were offered, would you attend the session?

Technical Assistance

8. Has anyone had technical problems with their eSPARC computer and/or their Internet service?

   a. Could you describe the problem(s) to me?
   b. Was the problem resolved? How?

9. Is everyone aware of the eSPARC technical assistance hotline? *(Show sticker and note how many parents are aware of the hotline. Mention it is on mouse pads)*

10. Has anyone here called the eSPARC technical assistance line? *If yes, how was that experience?*

11. What types of things might prevent you from using the toll-free number to discuss a technical problem?

eSPARC Website and Newsletter

12. Will you raise your hand if you know about the eSPARC website? *(Note how many parents do.)*

    a. How did you learn about the website?

13. *(If applicable)* Have any of you or your 5th grade children been to the eSPARC website?

14. *(If applicable)* How many times have you visited the web site—and when was the last time you visited the web site?

    For those of you who have been on the website:

    a. What did you think of the web site?
    b. Were you looking for specific information on the website?
    c. Was information easy to find?
    d. Was there something you were looking for that you could not find?

15. *(For everyone)* What kinds of information do you think would be most useful to have on this website that's not on there already from the pages I've given you?

16. Please raise your hand if you have received an eSPARC newsletter—it looks like this *(hold up)*?

17. Looking over the newsletter, what do you think about it?

    a. Is the information helpful? Interesting?
    b. What information could they add that would be most useful for you in future newsletters?

18. What is the best way to contact you about eSPARC activities and events, like the evening training sessions? (phone call, letter mailed, letter sent home with child, email)

Impact of Having a Home Computer

19. Do you and your 5th grade child work on the eSPARC computer together? *[If yes, probe for frequency and type of use. If no, probe for reasons don't work together on the computer.]*

20. What have you been able to do as a result of having the eSPARC computer that you could not do before?

21. What's been the best thing about having the eSPARC computer in your home?

22. If you had the opportunity to talk the Pennsylvania State Department of Education on the topic of your eSPARC computer, what would you say?

23. Is there anything about your eSPARC computer that we have not covered that you would like to discuss?

eSPARC Parent Focus Group Guide
July 2006
Follow-up to Post Parent Surveys

Introduction and Meeting Guidelines:

1. Good evening and welcome. Thanks for taking the time to join our discussion about the eSPARC computer program. My name is _____ and I am from Westat, a research organization in Maryland with expertise in educational evaluations. We have been conducting the evaluation of the eSPARC program and you probably know us from the telephone surveys that you have completed as part of our study.

2. We have been asked by the Pennsylvania Department of Education to help them get some information about how parents feel about the eSPARC program. They want the information to help determine how home computers may (or may not) benefit families.

3. Just so you know, each of you was selected to participate in this focus group based on some of your answers to the survey administered last spring. We have chosen some of these survey questions to follow-up on in this focus group.

4. There is no right or wrong answer to the questions we are going to ask tonight. We just want to know what you and your child's experiences have been with the program. Most important to us is that you feel comfortable giving us your honest opinions.

5. If you want to follow up on something that has been said, you want to agree, or disagree, or give an example, feel free to do that. Feel free to respond to one another about these questions as well. We're interested in hearing from each of you, so sometimes, I may call on you. Other times, I may go around the room to hear from everyone.

6. Please know that everything we discuss tonight will be strictly confidential. When we give a summary of the meeting to the Pennsylvania Department of Education, names will not be used.

7. We are going to be asking a lot of questions about your experiences with eSPARC, but have left time at the end of the session for whatever you want to discuss. At the close of the hour, we will hand out payments and ask that you sign a receipt.

8. Before we begin, I'd like to go around the room and ask each of you to introduce yourselves and tell us how long you have lived in the area.

First, I'd like to ask you some questions about your <u>Child's Use of the Computer</u>

1. **For what kinds of things does your 6th grade child most use your home [eSPARC] computer? What about things he/she uses it for less often?**

   Prompt as needed: word processing stories/spelling words, games, presentations, Internet searching for hobbies or for school assignments/homework, emailing

2. **What types of websites does your child routinely visit?**

3. **Has your child used the home [eSPARC] computer *this year* for any school-related assignments or homework? If yes, give examples.**

   - On average, how often would you say your child uses your home [eSPARC] computer for schoolwork?
   - How does this compare with his/her use of computers for school assignments *before he/she had a <u>home</u> computer*?

4. **For those of you who have 6th grade children who use the home [eSPARC] computer for game playing, what types of games does your child play, i.e., are they educational games or arcade-type games?**

   - For educational games, how did your child find out about the games?
   - What types of things do the educational games teach your child to do?
   - How often does your child play educational games? Arcade-type games?
   - How do you feel about arcade-type games in general? Do you see benefits to them? Drawbacks?
   - Do you have any guidelines or rules in your house about computer use, including the use of the computer for games or other activities?
   - Do you think that your child has learned the necessary tools and information to make best use of your home [eSPARC] computer for *school-related* purposes?
   - If yes, who or what helped them to use the computer in this way?
   - If no, what do you think needs to happen in order for your child to make better use of the home [eSPARC] computer for schoolwork?

5. **In general, do you think that having the home [eSPARC] computer has affected your child's interest in school at all? If so, how?**

   - How about your child's behavior at home?
   - Overall confidence in his/her abilities?
   - Attitudes about computers?
   - Time he/she spends with friends/playing outside?
   - Relationship with siblings?

6. **Do you and your [6th grade] child use your home [eSPARC] computer together?**

   - If yes, how often and for what purpose?
   - Have you ever helped your child find information about his/her interests or hobbies?
     - What information have you helped your child find that was related to his/her interests or hobbies?
   - Do you ever play educational or arcade-type games with your child?

- Did you ever spend time together using computers before you had the eSPARC computer?
- If no, what keeps you from using the computer together?

7. For those of you who have worked on a computer with your child for doing school assignments, what type of assignments were they?

- How often would you say you work with your child on the computer for doing assignments?
- Did your child come to you for help on the home [eSPARC] computer or did you offer the help?
- *(if applicable)* What keeps you from using the computer to help your child with schoolwork as much as you would like? Personal computing skills? Nature of the schoolwork? Time?

Now I'd like to ask a few questions about how YOU use the computer for your own purposes.

8. How many of you use your home [eSPARC] computer or your home Internet to… ***(Raise hand if <u>ever</u> used home computer in this way. Suggested follow-ups included—ask only if raised hands indicate.)***

- Get news, sports, or weather information
- Get information about your hobbies or interests
- Play games
- Get information about jobs in or around the area
- Do things related to your work
- Pursue an educational degree/take an online course or do research for a course
- Type or do word processing (including spell check)
- Comparison shop
- Anything else that you use your computer for that we did not cover here? Explain.

Get news, sports, or weather information?

- Has having a home computer changed how you stay informed?
- For example, do you read the newspaper less for the news? Watch the weather channel less?

Get information about your hobbies or interests?

- What types of hobbies/information/websites?
- How did you used to get information about your hobbies or interests?

Play games?

- What type of games?
- Is the eSPARC computer powerful enough to play the types of games that you like?

Get information about jobs in or around the area?

- Where on the Internet do you go to get this information?
- Do you do a special search for certain kinds of jobs?
- Aside from computers, where else do you search for information about jobs? Which source (including computers) is most useful to you? Why?

Do things related to your work?

- What type of work-related things do you typically do at home on the computer?

Pursue an educational degree/take an online course or do research for a course?

- What types of things do you do towards fulfilling the degree?
- What type of course or research?
- If a course, what type of assignments do you do online?

Type or do word processing (including spell check)?

- What are some examples of documents that you have typed at home?

Comparison shop?

- What types of products were you looking to compare prices/quality?
- What websites did you visit?

9. How many of you have accessed your child's school or school district website?

- Of those of you who have, what types of information were you looking for? Did you find the information you were looking for?
- What additional, useful information did you find that you did not anticipate?
- Had you been to the school or district's web site prior to having the eSPARC computer?

10. How many of you have gone to another education-related website?

- What was the website?
- How did you find out about it?

Now, I'd like to ask you about your computer skills.

11. In general, do you think that your computer skills have changed at all as a result of having a computer in the home?

- Are there things you have learned about using a computer that you did not know before you got one in your home?

12. Some parents on our survey responded that they sometimes feel frustrated when using computers. How many of you have felt this way? Why?

13. How many of you purchased books about computers since having the home [eSPARC] computer?

- What were the book topics?

14. How many of you installed software on your computer this year?

- What is the software used for?
- Did anyone install any type of computer upgrade?

15. How many of you took a class or some type of short course related to computer use or use of computer software this year? *(Course may have been sponsored through work, the community, or a fee-based organization or school/university).*

- Explain why you took the class and the nature of the class.

Finally, I'd like to conclude with some questions about your Experiences and Perceptions of computing.

16. What have been the biggest advantages of having a computer in the home *for your child*?

- For you?
- What have you/your child been able to do as a result of having the eSPARC computer that you could not do before?

17. What have been the biggest *disadvantages* of having a computer in the home for your child?

- For you?

18. After having had a home computer for nearly two years now, would you say that your general opinion of computers has changed at all?

Explain*, then prompt:*

- Has the amount of time you want to spend on computers changed?
- Has your opinion changed about how computers may help children do better in school?

19. If the state of Pennsylvania were to offer this program again, what suggestions would you have for improving it?

Prompts:

- Delivery of computers
- Quality of computers
- Quality of printers/speakers
- Inclusion of software
- Internet service
- Technical assistance
- Training (required and voluntary)
- Website/newsletter communications

APPENDIX G: CASE STUDY PROTOCOLS

Student Case Study Interview #1

All questions that pertain to the survey will be checked for applicability according to each child's responses (see Response table), and to treatment/control status. Relevant questions will be marked on individual interview protocols for each child (☐). Some questions may be too difficult for students to answer; interviewer should be responsive to the behaviors/mannerisms of the child.

(Questions to follow up from student survey --had high frequencies or want additional information
1j, 3b, 4a, 6b, e, g, h, 14, 17, 18 b, c, e, 19-20, 25, 27)

A) How fifth graders use computers for school-related purposes

☐ 1) In general, how does a computer help you with schoolwork?

[Prompts: Do you use it to type stories or other papers? Do you use it to print out pictures of people, places, or things for an assignment? Do you use it to find information about things you are talking about in your class? Are there certain websites that you like to go to that help with your schoolwork? If so, are these websites that you found on your own or that your teacher told you about?]

☐ 2) What types of things do you do on your computer that have to do with <u>math</u>? Do you do these things at home or at school? (q14a)

[Prompts: Do you know the names of any games or websites that have to do with math? How do you know about them? What types of math problems are you better at because of using a computer? i.e., Can you multiply/divide/add faster? Do you know fractions better? Do you know how to work out a word problem better? Do you know where to go on the Internet to find out an answer to a math problem or question?]

☐ 3) What types of things do you do on your computer that have to do with <u>language arts</u> (or reading, writing, spelling)? (q14d) Do you do these things at home or at school?

[Prompts: Do you know the names of any games, word processing programs, or websites that have to do with reading or language arts? Do you ever read short stories or books on the computer? Do you think you are a good typist? Do you know how to do spell check, change type size, and other things like that? Explain.]

4) *I see on your survey that you told us…… [ASK A or B depending on applicable response]*

☐ A) My school work is too hard (q1j). What is it that makes school work too hard? Are there times when you feel like using a computer makes the school work *even harder*? Explain.

OR

☐ B) What is it that can be frustrating about using computers (q18b)? *(Prompts: do you feel like you can't keep up with others in the class? Do you not get help when you need it? Do you understand the directions your teacher gives you or the directions on the website? Is it hard to find what you are looking for on the Internet?)*

☐ 5) What kinds of things do you understand better on the computer than without a computer (q18c)?

(*Prompts: Is it easier to figure out when you make a mistake on the computer? How? Do you remember information better when you read it on a computer than when you read it from a book? Do you remember information better when you see pictures of it on the computer? Do you pay better attention when you are working on a computer than when you are listening to your teacher?)*

5a) I see that using a computer makes learning more interesting for you. Can you tell me what makes using a computer more interesting than doing some other class activity (like reading, or listening to your teacher, or working on a poster, or working on a worksheet or in a workbook?)

☐ 6) Why do you like to write school reports better using a computer than writing them by hand (q18e)?

(Prompts: Does your writing sound better on a computer? Explain. Does it have less spelling errors? Do you think your teacher likes you to type on the computer instead of writing a story in your own handwriting? Why? Is it about adding more to your writing on a computer (like pictures, or different types of lettering, or nice borders)? What about moving your writing around to make it more organized?)

☐ 7) We've talked about how the computer helps you to [fill in], are these some of the things that have made you like school more (q27e)? Can you think of anything else that we haven't talked about?

B) How fifth graders use computers for non-school related purposes

☐ 8) What types of things do you like to do on a computer that don't have to do with school? Games, surfing the Internet, emailing? (q6 b, e, g, h, high frequencies)

☐ 9) Do you ever type up things that are NOT for school (q6b)? Give me a couple examples.

☐ 10) What types of websites and topics do you look at on the Internet that don't have anything to do with school (q6e)? Do you have some favorite websites (maybe about your favorite sport/hobby or favorite celebrity)—what are they?

☐ **(Treatment follow up) Did you know about these web sites before you got your eSPARC computer or did you discover them once you had it?**

☐ 11) What types of games do you play on the computer when you are not at school (q6g)?

☐ 12) Do you listen to music on computers (q6h)? *(If yes)* Do you put in a CD or go to a website to listen? Do you have any favorite music websites? Do you know how to download music from a website? Explain.

☐ 13) You said that you spend [fill in] time on your eSPARC computer in a typical weekend and you spend about [ ] time during a school week (q19-20). We just talked about all of these things you are doing on the computer (re-cap briefly)--are you doing the same things on the weekend as you are during the week? *(Probe for clarification)*

☐ 14) I see you sometimes use the computers at the [public library, relative's house, friend's house] (q3b). Which of the things we talked about do you do most often on the computer at [your relative's house or at the public library]? Do you make a special trip there to use the computer or are you already there for some other reason?

C) Whether computers affect interest in non-academic subjects (HH survey asks parents only about child's interest in hobbies)

D) Whether computers affect participation in non-academic activities (SS asks about TV, reading for fun, playing outside, talking to parents)

☐ 15) Have you ever gotten interested in something *that had nothing to do with school* because you read about it, saw pictures of it, or started trying to play/learn about it on the Internet? (Maybe a game, sport, hobby; maybe you got interested in a kind of animal, or type of car?) Explain.

☐ **(Treatment follow up)** Has having a computer at home made it easier for you to get interested in [fill in]? Has learning about [fill in] on the computer made you join any clubs, groups, or teams, at school, online, or in the community? *(If no,)* How do you follow up on [this new interest]?

☐ 16) Which would you rather be doing out of these four things: watching whatever you wanted on TV, reading whatever you wanted for fun, playing outside how you wanted, or using a computer for what you wanted? Explain,

☐ **(Treatment follow up)** Do you think having a computer has affected how much time that you 1) watch TV, 2) read, or 3) play outside? How? Is there anything else that you *used* to spend time doing, that now you spend less time doing since you have a computer at home? Are there fun things that you do on the computer that you didn't do before?

E) Child's pre-study habits (only have whether or not use computers outside of school)

☐ 17) Do you think you have used computers more in school this year as a 5th grader or during last year as a 4th grader? Have you used computers more outside of school (maybe at your house, a relative's house, or a friend's house) more this year or last year? Can you explain to me how you use computers differently this year than you did last year? *(Prompt: Did you use the Internet more? Did you play more learning games? Did you learn about something new?)*

Matter of fact, let's look more closely at some things you know how to do.

☐ 18) *(Scan q17 for 1-2 things they know how to do)* When did you learn how to [fill in]? When you were in what grade?

☐ **(Treatment follow up)** Do you think you have gotten better doing [fill in] since you have had the eSPARC computer or do you think you [cut and paste; work on spreadsheet; search for info on Internet] about the same? If better, how has the eSPARC computer helped you?

(Prompt: more time, specific websites, parents helping them along)

☐ **(Treatment follow up)** 18b) I see that using the eSPARC computer has made you feel more confident about the things you can do (27a). Are the kinds of things we've been talking about [re-cap], what you meant by being more confident? Are there other things it has made you more confident about?

[Prompt: Inquire about academics first; then Do other kids know you have a computer? Has just having a computer made you feel better about yourself?]

☐ 19) *(Scan never done's or not sure's in q17)* Now, I see a few things that you are not sure you have done [read one or two]. Have you been able to learn how to do any of these since you filled out the survey?

☐ 20) *(Scan for yes answer in q25b)* I see that you told us before that one of the reasons that make it harder for you to use your eSPARC computer is that sometimes you don't know *how* to use it. Other than the things we just talked about, is there something else that you need to know to make it work better for you?

(Prompts: how to open a program; how to get on the Internet)

(THIS SECTION FOR TREATMENT ONLY)

F) Whether or not computers affect family relationships (relationship between child and parent; between child and sibling(s)

☐ 21) Since you got the computer, do you think you talk to your parents *more* about things that have to do with school than you did before you got the computer? (or do you talk to them less or about the same?) Do you ever talk to them about things you see or read about on the Internet (that don't necessarily have to do with school)?

☐ 22) Do they ever ask you what kinds of things you are doing on the computer? Give me an example of something you might have talked to your parents about that had to do with the computer in some way (can be something you saw or were working on or a problem you had using the computer).

☐ 23) You told us you think you get along better with your parents since you got the computer (21b)? Can you explain why?

☐ 23b) You told us you think you get along better with your siblings since you got the computer (21c). Can you explain why?

☐ 24) I see that one of the reasons that make it harder for you to use your eSPARC computer is that your parents do no allow you to use it all the time (q25). Do your parents have any rules about using the computer? (If yes) Do you guys see eye to eye on those rules?

☐ 25) Do you ever sit down at the computer with your parent(s) (q8a)? (If yes, give me an example what you did during one of those times)

☐ 26) What types of things do you ask your parents to help you with on the computer (q4a)? What types of things do you help them with?

☐ 27) Do you think you talk to your brother or sister any more because of the computer in the house? Does your brother or sister use the computer?

☐ 28) Do you ever use the computer *with* your brother/sister (q8c)? What types of things have you done together? Has the computer affected how you get along with him/her/them (q27c)? Explain.

G) Assessment of eSPARC computer, software, Internet service, eSPARC website, eSPARC TA, training sessions (how much of this do we want to include considering the focus groups?)

☐ 29) Do you know about the eSPARC website? Have you ever gotten on there? Were you looking for something?

☐ 30) Is everything working well on your computer, like the Internet service, the printer, the computer programs?

31) I see that sometimes you share information that you have found on the Internet with your teacher or classmates. Can you tell me something that you remember finding on the Internet that you told your teacher or classroom friends about (maybe you even printed a picture or article about it)? How long ago was this?

32) I see that you have had some problems with your eSPARC computer, specifically problems with [the printer, Internet]. Can you tell me what was wrong exactly and if/how it got fixed?

eSPARC CASE STUDY COMPONENT
ASSIGNMENT SCENARIOS

Evaluation Question: To what extent are 5th grade children in the eSPARC study able to complete a series of computer and Internet-related tasks? To what extent do their abilities to complete these tasks differ by study status?

1) WRITING ASSIGNMENT SCENARIO

Purpose: to assess how treatment and control children approach an assigned research task, including the search for information and more specifically, the use of computers to access and siphon information

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Your teacher explains that you must do a report on an animal, specifically the rhinoceros. Your paper must include 3 different types of sources--ones that do not all come from the same place. Your paper must also include a visual such as a picture, drawing, or chart that is relevant to the rhinoceros.

Alternate topic:

- *Abraham Lincoln*

What 3 types of sources would you use (check all that child cites)?

- ❒ *Internet*
- ❒ *Internet, specifically NetTrekker*
- ❒ *Computer—other (e.g., CD-ROM)*
- ❒ *Encyclopedia*
- ❒ *Book (in school library)*
- ❒ *Book (from public library)*
- ❒ *Book (from some other source)*
- ❒ *Magazine*
- ❒ *Video or DVD*
- ❒ *Other (specify):* _____
- ❒ *Other (specify):*_____
- ❒ *Other (specify):* _____

Which of these sources will you try to find 1st? 2nd? 3rd? Why?

How will you find them?

Note child's responses—will he ask his teacher? Ask his parents? Librarian? Go to the online library database? Go to the science section in the library and browse books?

Let's say that your teacher requires that you have at least one Internet source. How would you go about finding information on the rhinoceros on the computer?

After child briefly explains method, ask him casually if he would mind showing you what he means and re-locate to nearby computer. Explain that you would like child to explain aloud, step by step, what is he doing/thinking and model with him how to talk it out (e.g. explain to him aloud, step by step, how to make a peanut butter and jelly sandwich).

Re-state his process as necessary: **Ok so next, you are going to….then next you are going to**….

As child searches for information, note the following:

- *Does child use an online library database to check for books about the rhinoceros?*
- *Does child use a search engine to access information? Which one?*
- *What words or key phrase(s) does child type into search engine? Does child appear satisfied with output results? Does child re-phrase inquiry based on output? Why? Note any new phrasing.*

Is this the way that you usually look for information on the Internet? Do you know of any other ways? *If so, ask him to demonstrate.*

How does child go about deciding which link(s) he will open? (REMINDER: continue to encourage child's step by step thought process; prod "What are you thinking now?" as necessary.)

What does child do upon entering a website? Skim first screen? Click on links? Open and close quickly?

Do you think that this site is a good web site for your report? Why or why not?

Ok, now I am going to ask you to find two things about the rhinoceros using the computer --you can find them any way that you would like and you can go to as many places on the computer as you'd like.

1) How long do rhinos typically live? *35-40 years*

2) What do rhinos eat? *Plants, trees, bushes*

3) What is the horn of the rhino made of? *Thickly matted hair that grows from the skull*

Alternate questions/answers for Abraham Lincoln (choose as time permits):

1) **In what year was Lincoln first elected president?** *(1860)*

2) **In what year was Lincoln killed?** *(1865)*

3) **Where is Lincoln buried** *(Springfield, Illinois)*

4) **What was the name of Lincoln's wife?** *(Mary Todd)*

5) **What were some of the jobs that Lincoln held before he was elected President?** *(store clerk, postmaster, rail splitter, lawyer, Congressman)*

6) **What were some of Lincoln's favorite foods?** F*ruit salad, cheese, crackers, Mary Todd White Almond Cake, Fricasseed Chicken.*

Note process by which child finds information. What does he do first, second, third, etc? What websites are visited? How does child decide? How many does he visit? What links are clicked? How long does it take to find the information?

How does he alter his actions based on his discoveries and thinking?

What are critical steps in helping him find the information that he needs?

Allow child no more than ten minutes to find the information. If he is unable to search the Internet and/or appears frustrated with the search, offer guidance as necessary, such as:

What do you think would be a good key phrase to get the type of websites you want? *Offer phrases as necessary*

Do you know about the Yahoo for kids search engine? *If not, provide website: http://yahooligans.yahoo.com/ and direct child to the links and search box*

Prompt child continually to talk through his thought processes while completing the task.

Remember that you must also have a picture/visual with your paper. What are some of your ideas for a visual to accompany your paper?

Note whether child would draw, arrange a picture himself or use the computer to find a picture. If the latter,

Where might you find a picture on the Internet to go with your paper?

Do you know how to print the picture? Do you know how to print the picture *by itself*, in other words without the words/text around it? Do you know how to download the picture? Cut and paste it?

Do you know of any places on the Internet where you might find a bunch of pictures to choose from?

Now that you have located several different sources and have your picture, what would you do as a next step for the report?

How do you think you would put all the information together?

Other than this topic, is there another topic that you've been really interested in that you would like to write a paper about?

Would you do anything different in finding information for this paper?

If child has already done a paper on this topic:

Tell me about what you did for this paper.

End task. Thank child.

2) DIFFICULT HOMEWORK ASSIGNMENT

Purpose: to assess extent of difference in how treatment and control students approach difficult school assignments, particularly differences in how computers are used as a resource in such circumstances

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Let's pretend that your math teacher gives you a really hard homework assignment to do. Like what are you working on now in your math class? Fractions, division? *(we will know ahead of time*). **Ok, so you have this super hard [division] problem to do. It doesn't matter what the exact problem is because I'm not expecting you to give me an answer. Just talk me through what you might do to get some help on a math problem that you don't know how to answer.**

Note child's responses. If he mentions non-computer-related help, ask:

Is this the only resource that you might use?

Note any other resources.

Which resources do you think will be most helpful, sort of helpful, and a little bit helpful in resolving this math dilemma?

If he does not mention computers, end task after noting his response

If he mentions computer help, ask him to demonstrate: **Can you show me what you mean on the computer?**

Re-locate to computer and observe. If child types in website address as a first step, note address, and skip next two questions in this sequence. If child types a phrase into a search engine, continue below.

So you would type in [ ] to find some help? How do you know about this site? Then what do you do next once on the site?

Note the child's process for getting help to his question.

If child types in generic question or phrase, note that as well. Is he satisfied with the results of his query?

How will you decide which site to open?

Does child open multiple sites? Does he appear to know how to navigate web sites efficiently for his purpose? Does he use any search tools or help tools on the site itself?

Do you think this site will give you the help that you need? Why/how do you know?

Are there other web sites that you might consider? Why?

End task. Thank child.

3. TARGETED COMPUTER SKILLS

Purpose: to assess whether there are differences in the computer-related skills of treatment and control children; to assess reliability of survey responses relating to skills; to assess targeted skills in the areas of writing for organization (cutting and pasting), Internet searching/retrieval (bookmarking), and emailing (including file attachments).

Part A. Now, I'm going to read you a few sentences slowly and ask you to type them. *(Show child print out of sentences if necessary)*

Type the following:

Ray Rag ran across a rough road.
Across a rough road Ray Rag ran.
Where is the rough road Ray Rag ran across?

Can you read me what you typed?

Do you know how to make the last sentence bigger than the other ones? *If so, ask child to demonstrate.*

Ok, now I'd like for you to re-arrange the tongue twister so that the last sentence is the first sentence and the first sentence is the last sentence.

Note if child chooses to re-type sentence or cut and paste the sections. If the former, ask:

Do you know of another way to re-arrange the sentences besides re-typing them?

Note response. If child mentions cutting and pasting, ask:

Will you show me?

After demonstration, ask:

When you are writing a paper for school, do you ever rearrange text like this?

Continue.

Part B. Ok, now we've got this new tongue twister. If I wanted to keep your version of this tongue twister and didn't feel like writing it down right now, would you be able to email it to me?

If yes, (technology permitting) ask child to do so (provide your email address). Some of the children may have set up AOL accounts or eSPARC email accounts. FYI: the eSPARC login is qmail.cliu.org and children were given eSPARC emails and passwords with their computers.

If child re-types sentence into email, ask:

Do you know how to attach it to my email as a separate thing for me to open?

If yes, ask to demonstrate. Make note of process. Continue.

If applicable, **When you are working on an assignment for school, have you ever used email?** *If yes,* **can you give me an example?**

If no, continue.

Part C. Do you have any favorite websites? *If yes,* **will you show me?**

*If no,***What do you think is a really fun thing to do?**

Ok, let's find out more about that on the computer. How do you think we can do that?

Note child's method of finding information.

Do you like this web site? Does it seem like a good one that you might want to visit again one day soon?

Once child agrees that a website looks interesting to him, ask:

Do you know how to save this website somewhere so you can go back to it without having to look for it again (or type in the address again)? *If needed***, Some people call it bookmarking.**

If yes, **Will you show me?**

Make note of method, thank child, end task.

If no, thank child, (show him if he'd like), end task.

APPENDIX H: TEACHER LOG

Teacher Name: **Date:**

Student	**During the past grading period, to what extent did <u>each</u> of the following students:** *(check <u>one</u> response for each option):*				
	(A)	(B)	(C)	(D)	(E)
	Complete his/her homework[1] accurately and thoroughly—rather than just try to get by?	Use multiple sources—that were *relevant, appropriate and current*—to prepare written assignments and/or projects?	Use computers and/or the Internet to *locate and retrieve* information?[2]	Use computers to *present* information—e.g., to type reports or prepare graphics/data?	Come to school prepared to participate in class on a daily basis?
Student A	*(1-6)*	*(1-6)*	*(1-6)*	*(1-6)*	*(1-6)*
Student B					
Student C					
Student D					
Student E					
Student F					

1 = Did NOT meet classroom requirement
2 = Partially met classroom requirement
3 = Met the classroom requirement
4 = Somewhat exceeded classroom requirement
5 = Greatly exceeded classroom requirement
6 = Not Applicable

[1] Homework includes assignments and projects started in class and finished outside of the classroom (e.g., in the library after school, at home)—as well as assignments and projects completed entirely outside of the classroom.

[2] For items C and D, please respond to the extent that computers were used in class OR outside of class. In other words, regardless of where the student used a computer, to what extent was the classroom requirement met?

Student	**During the past grading period, how *frequently* did <u>each</u> of the following students:** *(check <u>one</u> response for each option):*					
	(F)	(G)	(H)	(I)	(J)	(K)
	Edit and revise assignments—e.g., to correct spelling or math errors, improve sentences, include additional details?	Share verbal or printed information with you or with others (e.g., classmates) that is relevant to a classroom topic(s)?	Ask informed or insightful questions in class?	Show persistence when confronted with difficult problems?	Work to the best of his/her ability on a daily basis?	Use e-mail to communicate with you about their school work?
Student A	*(0-4)*	*(0-4)*	*(0-4)*	*(0-4)*	*(0-4)*	*(0-5)*
Student B						
Student C						
Student D						
Student E						
Student F						

0 = Never
1 = Rarely
2 = Sometimes
3 = Frequently
4 = Don't Know
5 = Not Applicable

Student	**During the past grading period, how often did the parents of <u>each</u> of the following students:** *(Check <u>one</u> response for each item.)*									
	Contact you via telephone?		Contact you via e-mail?		Contact you via typed or hand-written note?		Visit you at school?		Receive a phone call, personal e-mail, or hand-written note *from you*?	
	Frequency	Purpose	Frequency	Purpose	Frequency	Purpose	Frequency	Purpose	Frequency	Purpose
Student A	*(0-5)*	*(A-K)*	*(0-5)*	*(A-K)*	*(0-5)*	*(A-K)*	*(0-5)*	*(A-K)*	*(0-5)*	*(A-K)*
Student B										
Student C										
Student D										
Student E										
Student F										

0 = Never
1 = Once
2 = Twice
3 = Three times
4 = Four or more times
5 = Don't know

A = Discuss behavioral or emotional problems
B = Discuss grades
C = Discuss assignments and/or homework
D = Discuss field trips and/or school events
E = Discuss improvements in student performance
F= Discuss improvements in student behavior
G= Discuss eligibility and/or access to student services
H= Discuss reasons for past absenteeism
I= Notify teacher of upcoming absence
J= Request/schedule parent-teacher conference
K = Other

APPENDIX I: TEACHER SURVEY

PENNSYLVANIA DEPARTMENT OF EDUCATION
OFFICE OF EDUCATIONAL TECHNOLOGY
333 MARKET STREET
HARRISBURG, PENNSYLVANIA 17126-0333

EVALUATION OF THE STUDENT AND PARENT ACCESS TO REFURBISHED COMPUTERS (ESPARC) PROGRAM

TEACHER SURVEY

The evaluation of Student and Parent Access to Refurbished Computers (eSPARC) is an experimental study designed to assess the impact of providing refurbished computers and Internet access to the families of fifth grade students in four communities in eastern Pennsylvania. The 3-year study, funded through a grant from the U.S. Department of Education, randomly assigned 355 families that did not have a home computer to either a treatment or control group—with treatment group households receiving a donated refurbished home computer with Internet access during the 2004-05 school year (households assigned to the control group will receive the same benefits in the 2005-06 school year). The purpose of the study is to assess whether the provision of home computers improves student achievement and parental involvement in their children's education.

This survey is designed to obtain information about the extent to which the 5th grade students in the study used computers in the classroom. Other information that we are collecting will be included in a statistical model that assesses whether teacher characteristics and classroom practices had an effect on students' home computer use. The information that you provide will be combined with information from all of the teachers whose students are enrolled in the study. Findings from individual surveys will not be shared with anyone in your state, district, or school.

ATTACH LABEL

PLEASE RETURN THIS SURVEY TO THE ESPARC LIAISON FOR YOUR SCHOOL WITHIN ONE WEEK	IF YOU HAVE ANY QUESTIONS, CALL BRIAN KLEINER AT 1-800-937-8288, EXTENSION 4469

1a. How many instructional computers and laptops are currently located in your classroom? _____

1b. How many of these computers and laptops currently have access to the Internet? _____

2. How often do your 5th grade students use computers and/or the Internet (either in the classroom or in a computer lab/media center) *during the school day*? *(Check one.)*

- ❒ Several times a week
- ❒ At least once a week
- ❒ At least once a month
- ❒ Several times a year
- ❒ Never
- ❒ Not applicable—my school does not make computers and/or the Internet available to my students

3. How often do you assign *homework* that requires your 5th grade students to use a computer and/or the Internet? *(Check one.)*

- ❒ Several times a week
- ❒ At least once a week
- ❒ At least once a month
- ❒ Several times a year
- ❒ Never

4. How often do you assign your 5th grade students work that involves using computers or the Internet to do the following things? *(Circle one on each line. Circle N/A in the last column for any capabilities that your school does not currently have.)*

	Several times a week	At least once a week	At least once a month	Several times a year	Never	N/A
a. Perform practice tutorials or drills (*individual and/or whole class*) ..	1	2	3	4	5	6
b. Type a story or report using a word processing application	1	2	3	4	5	6
c. Conduct research using the Internet.....	1	2	3	4	5	6
d. Use drawing or painting software.....	1	2	3	4	5	6
e. Display information using charts or graphs.....	1	2	3	4	5	6
f. Perform calculations with computers or spreadsheets.....	1	2	3	4	5	6

5. Please indicate the extent to which *YOU* use computers or the Internet (at school or at home) for each of the following activities. *(Circle one on each line.)*

Activity	Not at all	Small extent	Moderate extent	Great extent
a. Creating instructional materials (i.e., handouts, tests, etc.)	1	2	3	4
b. Gathering information on the Internet for planning lessons	1	2	3	4
c. Using the Internet to access research about teaching and learning.....	1	2	3	4
d. Incorporating web content into lesson plans.....	1	2	3	4
e. Using software (e.g., PowerPoint) to create classroom presentations	1	2	3	4
f. Maintaining administrative records (i.e., grades, attendance, etc.).....	1	2	3	4
g. Using e-mail to communicate with colleagues/other professionals.....	1	2	3	4
h. Using e-mail to communicate with students' parents	1	2	3	4
i. Using e-mail to communicate with students outside of the classroom	1	2	3	4

6. To what extent do you agree with each of the following statements about the impact of integrating learning technologies into classroom instruction *(Circle one on each line.)*

Impact	Strongly Agree	Somewhat Agree	Somewhat disagree	Strongly disagree
a. It enhances the curriculum and connects it to real-life situations	1	2	3	4
b. It allows for more individualized instruction	1	2	3	4
c. It engages the students in challenging and authentic tasks	1	2	3	4
d. It helps students search for/communicate information effectively	1	2	3	4
e. It promotes self-motivated learning and a sense of exploration	1	2	3	4
f. It develops critical and creative thinking skills	1	2	3	4
f. It takes away classroom time best spent on other activities	1	2	3	4
g. It contributes to students' increased interest in school	1	2	3	4
h. It encourages parental involvement in the learning process	1	2	3	4

7. To what extent has each of the following *prevented* you from taking full advantage of computers and/or the Internet in developing your classroom instruction? *(Circle one on each line.)*

Barrier	Not a barrier	Minor barrier	Moderate barrier	Major barrier
a. Lack of working computers	1	2	3	4
b. Computers too complicated to use	1	2	3	4
c. Inadequate hardware upkeep and repair	1	2	3	4
d. Inadequate electrical wiring	1	2	3	4
e. Lack of instructional software	1	2	3	4
f. Software too complicated to use	1	2	3	4
g. Too few computers with Internet access in the building	1	2	3	4
h. Slow or unreliable Internet connections	1	2	3	4
i. Lack of time in school schedule to use computers	1	2	3	4
j. Demands of curriculum or mandated tests	1	2	3	4
k. Inadequate computer-related training for teachers	1	2	3	4

8. How many 5th grade students do you currently have in your class? _____

9. In your opinion, what proportion of your 5th grade students have advanced computer skills, basic computer skills, and below basic computer skills?

_____ % Advanced computer skills

_____ % Basic computer skills

_____ % Below basic computer skills

100 %

10. Including this school year, how many years have you been employed as an *elementary* school teacher *(include years spent teaching both full-time and part-time, as well as time spent in both public and private schools)*

_____ years

11. What is the highest degree that you have attained? *(Check one.)*

- ❒ Bachelor's degree
- ❒ Bachelor's degree with graduate credits
- ❒ Master's degree
- ❒ Master's degree with additional credits
- ❒ Doctoral degree

APPENDIX J: COMPUTER MAINTENANCE SURVEY

eSPARC Computer Maintenance Telephone Notice

Hello, my name is [INTERVIEWER NAME], and I am calling on behalf of the eSPARC program. May I speak to a parent of [CHILD'S NAME]?

YES	1	
NO [NOT AVAILABLE]	2	[SET CB APPT]

SECTION A

{My name is [INTERVIEWER NAME]. I am calling on behalf of the eSPARC program.} As part of the eSPARC study, we would like to invite you to bring your eSPARC computer in for a free tune-up. If you drop off your computer at (NAME OF ELEMENTARY SCHOOL) any weekday from August 1st to August 12th between 8:30 AM to 3:30 PM, we will clean up your machine's hard drive to improve the performance of your computer and help it to run faster. Also, bringing in your computer will ensure that there are no delays in your receiving a second year of AOL Internet service free of charge.

1. Do you think that you would be interested in dropping off your computer on one of these dates to have it tuned-up and improved?

YES	1	[GO TO SECTION B]
NO [UNAVAILABLE OR UNCERTAIN]	2	[SKIP TO SECTION C]
NO [NOT INTERESTED]	3	[SKIP TO SECTION D]

Reason_____

SECTION B

You should be receiving a letter with a map of the school where you will be dropping off your eSPARC computer. This letter also provides some instructions on what to bring in when you drop off your computer.

To prepare your computer for the tune-up, please be sure to back up any important files that you may have saved on your computer by saving them on floppy disks. If you have any questions about this, please call the eSPARC technical assistance line (GIVE IF ASKED: 1-877-4-ESPARC)

When you drop off your computer, please bring ONLY the computer itself, and not any other parts which plug into it. This means you do NOT need to bring the monitor, your keyboard, your mouse, or your printer. When you go to (NAME OF ELEMENTARY SCHOOL) any weekday from August 1st to August 12th between 8:30 AM to 3:30 PM, please leave your computer at the main desk with the school secretary. We will contact you as soon as your computer is ready for pick-up.

[COMPLETE SURVEY]

SECTION C

Right now, these are the only scheduled days for computer drop-offs. We will let you know if other dates and locations become available.

[COMPLETE SURVEY]

SECTION D

[COMPLETE SURVEY]

SURVEY
So that we can better prepare for the computer tune-ups, I have several questions to ask you. This should only take about 3 minutes.

1. First, how well is your eSPARC computer currently working? Would you say… (*Check only one.)*

   - ❒ You are currently having **NO** problems with your eSPARC computer,
   - ❒ You are currently having a **FEW** problems with your eSPARC computer, (SKIP TO QUESTION 3)
   - ❒ You are currently having a **LOT** of problems with your eSPARC computer, or (SKIP TO QUESTION 3)
   - ❒ Your eSPARC computer is currently not working **at all?** (SKIP TO QUESTION 3)

2. Have you **EVER** had any technical problems with your eSPARC computer?

   - ❒ Yes
   - ❒ No (GO TO CLOSE)

3. What types of technical problems have you had with your eSPARC computer? *(Ask question and record all responses. For <u>each</u> problem respondent identifies, ask if the problem is STILL occurring.)*

Type of problem	Check if problem EVER occurred	Check if problem is STILL occurring
Computer will not start	❒	❒
A specific computer program or application did not work	❒	❒
Computer freezes	❒	❒
Computer too slow	❒	❒
Monitor does not work	❒	❒
Computer is not hooked up	❒	❒
Mouse freezes/would not work	❒	❒
Printer jammed/would not work	❒	❒
Internet would not connect	❒	❒
Internet interruptions/sudden disconnects	❒	❒
Internet connection was too slow	❒	❒

Trouble with AOL account	❒	❒
Other (specify):	❒	❒
Other (specify):	❒	❒

4. Do you know about the toll-free eSPARC telephone assistance hotline that you can call to report problems with your eSPARC computer and obtain technical assistance?

   ❒ Yes
   ❒ No (GO TO CLOSE)

5. How many times have you or someone in your household called the eSPARC technical assistance line?

   ❒ Never (GO TO CLOSE)
   ❒ Once
   ❒ 2-3 times
   ❒ 4 or more times

6. How useful was the assistance provided by the person who handled your call? Would you say… (*Check only <u>one</u>.)*

   ❒ Very useful,
   ❒ Somewhat useful, or
   ❒ Not useful at all
   (Specify why_____)
   ❒ CAN'T SAY—SOMEONE ELSE IN HOUSEHOLD CALLED THE HOTLINE

SECTION B CLOSE: Those are all the questions that I have for you. We look forward to seeing you at (NAME OF ELEMENTARY SCHOOL) any weekday from August 1st to August 12th between 8:30 AM to 3:30 PM for your computer tune-up.

SECTION C CLOSE: Those are all the questions that I have for you. Thank you for your time and your participation in the eSPARC program.

SECTION D CLOSE: Those are all the questions that I have for you. Thank you for your time and your participation in the eSPARC program.