LOS ANGELES UNIFIED SCHOOL DISTRICT

PROGRAM EVALUATION AND RESEARCH BRANCH

TO: Members, Curriculum and Instruction Committee **DATE:** December 1, 2004

FROM: Ted Bartell

SUBJECT: **EVALUATION OF THE MIDDLE SCHOOL TECHNOLOGY PROJECT – YEAR 1**

This report contains findings from the first year of a two-year evaluation of the Middle School Technology Project (MSTP) and focuses on the implementation of the Plan during the 2003-04 school year. We employed an experimental design with matched groups of students in a treatment group and a control group. Both groups were selected randomly. Data collection included classroom observations; teacher, coach and administrator interviews; and shadowing of instructional coaches. In addition to analyzing existing CAT/6 and CST data, we administered two performance-based assessments, the Balanced Assessment in Mathematics and the Partnership for Assessment in Standards-Based Science. The following were key findings:

- MSTP teachers did use some of the technology provided to them by the spring of 2004. Technology was more prevalent in science classrooms than in mathematics classrooms. Yet, similar technology was used by control teachers leading to very few differences between treatment and control classrooms in technology use.
- Most teachers used technology to maintain existing practices rather than enhance student development of problem solving and reasoning skills and student understanding in mathematics and science. We did not see any evidence that technology had increased the teachers' ability to facilitate more standards-based and project based mathematics and science instruction.
- With respect to professional development, we found that many teachers did not attend the formal trainings provided to them. The formal professional development primarily focused on introducing teachers to the MSTP technology for use in their classrooms.
- We found inconsistencies in the delivery of site-based support for teachers. MSTP coaches were tasked with a wide range of responsibilities in addition to their direct coaching responsibilities. This over-tasking combined with limitations created because of teachers' lack of time and constraints imposed by the coaching model itself impacted the coaches' ability to provide direct support to teachers to help them integrate the technology into their curricula.

If you have questions about this report, please contact the Project Director, Rina Hoffer at (213) 241-8278 or rina.hoffer@lausd.net.

Evaluation of the Enhancing Education Through Technology:

Middle School Technology Project –Year 1

Rina Hoffer

Los Angeles Unified School District
Program Evaluation and Research Branch
Planning, Assessment and Research Division Publication No. 230

November 30, 2004

Acknowledgements

I would like to offer special thanks to Rosa Valdés and Julie Slayton for their invaluable assistance in the development of this report. I would also like to thank the teachers and coaches in our study for their instrumental assistance in supporting us in our data collection efforts.

TABLE OF CONTENTS

EXECUTIVE SUMMARY i

Method ii

Findings iii

Recommendations v

Next Steps vi

Introduction 1

Research Questions 6

Method 7

Data Collection 10

Data Analysis 14

Findings 15

Conclusions 38

Recommendations 40

References 42

Appendices 44

EXECUTIVE SUMMARY

This document contains the findings from Year 1 of a two-year districtwide evaluation of the Middle School Technology Project (MSTP). The first year report is intended to provide formative feedback on the implementation of the program and its relationship to student achievement. In Year 1 (fall 2003) we collected the following data: teacher, administrator, and coach interviews; classroom observations of instructional practice in mathematics and science classrooms; professional development offered to teachers; and student pre and posttests. The study examines the extent to which the program: 1) was implemented in the first year and affected teachers' practice by increasing their use of technology and their delivery of standards-based and project-based curricula, and 2) impacted student performance in mathematics and science classrooms.

The MSTP is a two-year grant intended to improve middle school students' mathematics and science achievement by integrating technology into the curricula. The MSTP consists of the following three components: 1) provision of the technological resources, networking and access to instructional materials in mathematics and science, 2) professional development to teachers in order to increase their proficiency in the use of technology in the classroom, and 3) opportunities for students to use technology in their mathematics and science classroom. The goals of the MSTP were to provide teachers with the equipment and professional development support to enhance their delivery of Project-Based Learning and to work toward the Teaching for Understanding (TFU) model developed at Harvard University. It was expected that increasing teachers' range of instructional strategies, including the increased use of technology, would lead to greater student performance in mathematics and science and also advance their proficiency in the use of technology.

The research questions addressed in this report are:

1. To what extent have the MSTP efforts led to the integration of technology standards-based and project-based curricula in mathematics and science classrooms?
2. To what extent did the professional development offered through the MSTP impact teachers' ability to use technology and deliver more standards-based and project-based instruction?

3. To what extent has the infusion of technology in the program schools yielded gains in student performance?

Method

This study employed an experimental design with matched groups of students in a matched treatment group and a control group. Using a stratified random selection procedure, we chose eight schools that had schoolwide Title I programs and mid-range values on the SCI: four schools were selected as matched treatment schools, and four schools were selected as control schools. Then, at the request of program staff, an additional four schools were added to the study as schools that were part of the program. These four schools did not meet the same criteria as the matched treatment and control schools. Thus, these schools were considered "non-matched" treatment schools. The non-matched treatment schools were combined with the matched treatment schools only for the purposes of examining program implementation.

Once the schools were selected, we randomly selected seven teachers at each of the twelve middle schools: three 6th grade teachers (teaching both core math and science courses), two 7th grade science teachers, and two 7th grade math teachers, for a total of eighty-four teachers. We then randomly selected one class period for each teacher in order to observe classroom practice and test students. Classes were selected based on a class size of at least 20 students, and thus the total number of students in our sample was approximately 1800.

The principal method used to collect data related to the implementation of the MSTP and teachers' use of technology was observation. We conducted observations in classrooms as well as at off-site and site-based professional development. Additionally, we interviewed teachers, coaches, principals, and technology coordinators. We examined students' California Standards Test (CST) and California Achievement Test 6th Edition (CAT/6) data in mathematics. We also administered two performance-based assessments to students – the Balanced Assessment in Mathematics (BAM) and the Partnership for the Assessment of Standards-Based Science (PASS).

Qualitative and quantitative data reduction and analysis were conducted with each type of data collected. First, we worked with a team of trained analysts to examine the quality of mathematics and science pedagogy in the fall and in the spring. We focused our analysis

of classroom instruction on the extent and quality of activities conducted in mathematics and science classrooms. In addition, we used classroom observation data to determine the resources and materials used and the amount of actual class time devoted to particular instructional activities.

In addition to classroom observation data, we analyzed teacher interview data to determine the frequency of use by matched treatment and non-matched treatment teachers of the technology and electronic curricular resource materials provided as part of MSTP. In addition, we attempted to identify issues regarding program implementation that may have influenced the effectiveness of the program. We also examined the control teacher interview data to determine whether they had access to similar technologies and if they made use of them during instruction. Coach interviews were analyzed to determine the factors influencing the on-site professional development provided to program teachers. We also analyzed principal interview data to identify organizational differences or qualities of leadership or support that may have impacted the program.

Findings

With respect to question one, we examined program implementation in two ways. First we looked at whether the technology provided to program schools was used by teachers during the school year. We found that teachers did use some of the technology provided by the program by the spring. Technology was more prevalent in science classrooms than in mathematics classrooms. This finding based on observation data was supported by teacher interview data. Mathematics teachers indicated that they felt the tools and resources were better suited for science instruction and that they experienced more difficulties in incorporating the technology into their lessons than the science teachers. A number of factors including delays in the roll out of the program related equipment and thefts impacted teachers' ability to use the MSTP provided technology. We also saw similar technology being used by control teachers. Thus, there were very few differences in the use of technology between matched treatment and control classrooms.

Second, we analyzed the data to determine whether teachers used the program technology and resources as teaching and learning tools to deliver standards-based and project-based curricula reflective of both the content and the process skills of developing reasoning and problem solving skills. We did not find that teachers used the technology in

new and different ways but instead used it to take the place of other methods of instructional delivery (e.g., using the Activboard instead of the overhead projector or blackboard). Consistent with the research on technological reforms in education (Cuban, 2000), most teachers used the technology to maintain existing practices rather than to enhance student development of problem-solving and reasoning skills and the development of student understanding in these subject areas. We also found minimal change in instructional practice reflective of problem solving activities. Instead, teachers continued to engage their students in basic-recall closed-ended questioning, reading their textbooks, and answering questions from the textbooks. We did not see any evidence to suggest that the technology had increased teachers' ability to facilitate more standards-based and project-based mathematics and science instruction.

With respect to question two, we examined whether the professional development offered to MSTP teachers had an impact on their ability to use the technology in the delivery of their lessons. We found that many teachers did not attend one or more of the formal trainings offered to program teachers. Not surprisingly, teachers who did not attend the formal trainings in the use of the electronic curricular resources were not likely to use them. Teachers also expressed a desire to have more in-depth trainings. In Year 1, the emphasis of professional development was on introducing teachers to the technology that made up the MSTP for use in their classrooms.

We found inconsistencies in the delivery of site-based support to teachers. The majority of support provided in Year 1 consisted of technical support rather than the modeling and lesson integration teachers were seeking. While 89% of the MSTP teachers expressed enthusiasm to be selected to participate in the program, and felt their participation in the program had a generally positive impact on their experience as a teacher, teachers did not believe they received the training or lesson modeling they needed to assist them in using the technology during instruction. Coaches were tasked with a wide range of duties that took valuable time away from their ability to deliver the site-based instructional support that teachers needed.

Additionally, we found that the coaching model of rotating coaches through the eight schools had an impact on coaches' and teachers' ability to develop rapport and an on-going relationship that would have translated into the provision of continuous teacher support.

With respect to the third question, student achievement data provided mixed results. On some tests, matched treatment students outperformed control students. On other tests, the control students outperformed matched treatment students. This held true for both grade levels. Thus, in Year 1, we did not find a program effect. Yet this finding is not surprising given the low levels of program implementation in matched treatment classrooms and the presence of technology in control classrooms.

It is our expectation that we will find greater program impacts in Year 2 of the study.

Recommendations

In light of the above findings, we make the following recommendations to ensure that the program is effectively implemented in Year 2.

Teachers should be provided with additional ongoing, in-depth professional development that not only instructs them about the mechanics of the technology, but also teaches them how to meaningfully integrate it equally across both content areas.

Coaches' time should be spent one-on-one with teachers, modeling lessons, and providing examples of ways to integrate technology into the curriculum. Coaches should deliver a consistent plan across schools and across subject matter such that program teachers receive an equal level of support on a continuous basis.

Program staff should consider targeting professional development opportunities with concrete examples of how to use the technology to teach the curriculum in both mathematics and science, so that teachers don't have to spend their time searching for examples of lessons that integrate the mathematics and science curriculum.

Program staff should consider involving and training the technology coordinators at each of the school sites to provide the technology support necessary to teachers.

Program staff should consider focusing professional development efforts on problem-based learning opportunities for students across both subject areas and enhance the opportunities for site-based formal trainings to ensure greater attendance at each of the school sites.

Program staff should consider providing coaches and MSTP teachers with opportunities to meet with each other on a more regular basis. Similarly, program staff should provide MSTP teachers with opportunities to meet with colleagues across program schools in order to learn from one another and share lessons learned. The addition of

technology to the educational program may require adjustments in the professional development opportunities built into the site-based professional development model at the school sites.

Next Steps

In the second year of the evaluation we will continue to examine the extent to which the MSTP is implemented in program classrooms and whether implementation translates into an increase in teachers' ability to provide their students with standards-based and project-based curricula. We will also continue to examine whether program implementation leads to increased student achievement in mathematics and science classrooms.

Introduction

This document contains the findings from Year 1 of a two-year districtwide evaluation of the Middle School Technology Project (MSTP). The first year report is intended to provide formative feedback on the implementation of the program and its relationship to student achievement. In Year 1 (fall 2003) we collected the following data: teacher, administrator, and coach interviews; classroom observations of instructional practice in mathematics and science classrooms; professional development offered to teachers; and student pre and posttests. The study examines the extent to which the program: 1) was implemented in the first year and affected teachers' practice by increasing their use of technology and their delivery of standards-based and project-based curricula, and 2) impacted student performance in mathematics and science classrooms.

This report is organized as follows. The introductory section presents the background of the evaluation (including an overview of the MSTP), a literature review of research on the use of educational technology, and the research questions for this year's evaluation. Then, we describe the methodology employed to examine the implementation and effectiveness of the MSTP, including a discussion of the sample selection, data collection and data analysis. Next, we present the findings regarding the implementation and the effectiveness of the MSTP deliverables to teachers and the program's impact on student achievement. Finally, we present the conclusions and recommendations and next steps as the study moves into its second year.

Background

The MSTP, a result of the Enhancing Education Through Technology funding provided by California Department of Education, is a two-year grant that is intended to improve middle school students' mathematics and science achievement by integrating technology into the curricula. The MSTP was designed to augment technology resources previously distributed at most K-6 and 9-12 sites throughout LAUSD. The MSTP provided 6th and 7th grade math and science teachers with a carefully chosen set of tools, resources and professional development to enhance their access to and use of technology for

instruction. The expectation was that by supplying teachers with the additional technology resources and training in their use as educational tools, teachers would be better able to deliver standards-based and project-based mathematics and science curricula. It was expected that increasing teachers' range of instructional strategies, including the increased use of technology, would lead to greater student performance in mathematics and science and also advance their proficiency in the use of technology.

The Middle School Technology Program

The MSTP consists of the following three components: 1) provision of the technological resources, networking and access to instructional materials in mathematics and science, 2) professional development to teachers in order to increase their proficiency in the use of technology in the classroom, and 3) opportunities for students to use technology in their mathematics and science classroom. The goals of the MSTP were to provide teachers with the equipment and professional development support to enhance their delivery of Project-Based Learning and to work toward the Teaching for Understanding (TFU) model developed at Harvard University. Sample teachers in the program schools received the following equipment:

- One 14 inch Apple iBook laptop
- Twenty 12 inch Apple iBook laptops (in a cart for students)
- Wireless Airport Station
- Eight Vernier probes each to measure (ph, Conductivity, Temperature and Motion)
- Eight Logger Pro interfaces (electronic data collection tools)
- Proscope digital microscope Kit
- A Promethean ActivBoard (Electronic White Board)
- Handheld Slate (Connected to the ActivBoard)
- Projector
- Digital Camera
- Laser Printer
- Scanner

Teachers were also given access to the following electronic resource materials:

- *Multimedia Services/Digital Curriculum-Los Angeles County of Education* – an extensive library of curricular resources aligned to the standards, with downloadable videos
- *Task Stream* – an electronic lesson planner that offers communication tools, file sharing and web page publication opportunities
- *Big Chalk* – a library of electronic resources aligned to the California and National Standards
- *Video* Discovery – a collection of 30,000 instructional graphics, photos and videos aligned to the Standards (Science related topics)
- *CTAP Online* – Electronic resource and database of standards-based lessons, lesson building tools and links to additional related resources, that allows for document sharing

Literature Review

Technology in the Classroom

A growing challenge in education is establishing and implementing strategies to develop the skills and knowledge necessary for teachers to effectively use technology as an instructional tool. While technologies have been touted as the essential tools of the teaching trade, the research has focused primarily on the impact of technology on students, with little investigation on the implications for teachers (Office of Technology Assessment, 1995). Teachers need to become more involved in the role they can play in changing their work environment. As many of the reform efforts over the last decade have found, it's not enough to simply infuse schools with technology and offer workshops to increase technology literacy. Teachers need the hands-on experience and the time to apply new techniques to delivering the curriculum and refining their instructional approaches.

As Cuban (2001) found, the monies invested in a wide array of technologies have yet to produce their desired outcomes. He found that most teachers using new technologies used them to maintain existing practices rather than adopting new practices as a result of the addition of the technology. Additionally, as those involved with Technology Literacy Challenge Grants over the last few years have found, not only does it take more than a few

years to get teachers comfortable with integrating technology into their daily lessons but also, once the funding subsides, the slow revolution to transform instruction subsides with it. Historically in education, technology has not been integrated well or to its fullest potential (Hasselbring & Tulbert, 1991; U.S. Department of Education, 1993; U.S. Department of Education, 2000). As Kosakowski (1998) points out, "technology cannot exist in a vacuum, but must become part of the whole educational environment" (p. 56) if it is to be used effectively. The North Central Regional Educational Laboratory (1999) argues that the successful integration of technology into the American educational system will involve recognition on the part of all stakeholders that it is not the technology alone that will promote student achievement. It is, rather, the use of the technology as it relates to the larger educational goals that are established by the district or school. In addition, the integration of technology into all aspects of teaching and learning takes time to establish, and the school day must be adjusted to allow this integration to occur.

If the integration of computers is going to be successful, it is critical that teachers be properly trained and involved in the integration process. Increasing the frequency, depth and breadth of opportunities teachers have to collaborate and discuss and critique their own pedagogy influences the instructional context and the quality of technology use (Becker & Reil, 2000). According to Lemke and Coughlin (1998), several conditions need to be in place: strong leadership, professional development, and the technological capacity of the system. First, teachers need ongoing, in-depth professional development that instructs them on the mechanics of the technology as well as how to use it meaningfully in an instructional setting. This goal cannot be achieved through a "one-time workshop" (North Central Regional Educational Laboratory, 1999, p. 6), but through in-depth and sustained training (Kinzer & Leu, 1997; North Central Regional Educational Laboratory, 1999). Educators must be made aware of the mechanisms by which technology use leads to student learning (Hasselbring and Tulbert, 1991). Second, effective use of technology in the classroom is not merely predicated on training in the use of this technology; it is also predicated upon teachers' knowledge and understanding of skill acquisition within each content area (Shulman, 1986). When teachers are trained in both areas, they will then be able to use technology "in appropriate ways to deliver powerful instruction" (Hasselbring & Tulbert, 1991, p. 36).

Student Learning

According to the National Council of Teachers of Mathematics (NCTM), regardless of the debate about what mathematical content is most important to teach, there is a growing consensus that what students learn, they should learn with deep understanding. Learning for deep understanding of mathematics requires effective communication in the classroom (NCTM 1989, 1991). This emphasis is echoed in the work of Ball (1993) about an inquiry classroom: the role of the teacher is to engage the students in meaningful mathematics discussions, in which students are asking questions, solving problems and formulating or critiquing mathematics arguments. This discourse is not the rapid-fire questioning and short answers typically seen in recitation-style mathematics lessons. Scientific literacy is defined as recognizing the interdependence of science, mathematics and technology, understanding key concepts and principles, and using this knowledge and ways of thinking for individual and social purposes (AAAS, 1989). Building on the work of the national reform efforts such as the American Association for the Advancement of Science's Project 2061 and the National Science Teacher Association Scope and Sequence Project, the vision described in the National Science Education Standards is remarkably consistent with that of the NCTM standards. Both agree that the focus should be on a limited number of concepts, emphasizing deep understanding, reasoning and problem solving rather than memorization of facts, terminology, and algorithms.

Professional Learning

Research that focuses on the areas of professional development (Guskey, 2000; National Staff Development Council, 1995), school reform (Elmore, 2002), leadership (Fullan, 2001) and organizational learning (Preskill & Torres, 1999) present many similar themes regarding the characteristics of organizations in which adults learn. At the organizational (school) level, this involves an integrated focus on the organization's ultimate goals (student achievement); organizational capacity for ongoing improvement; an organizational culture that promotes inquiry and reflection; and structures and systems that foster the generation and sharing of information to further develop teachers' learning. In terms of leadership, there should be a focus on instruction as the school's core activity, administrators should promote opportunities for staff learning, and leadership should be distributed among staff members. At the interpersonal and personal levels, important

characteristics are trust, a commitment to learning, positive relationships, listening and dialogue, and using mistakes as learning experiences. The role of the organizational context on the effectiveness of any school-based professional development is one that must be addressed. As Fullan asserted in *The New Meaning of Educational Change*, "To put it positively, the more factors supporting implementation, the more change in educational practice" (2001, p. 71). According to Elmore, the organizational contexts or structures of many schools are not adequate to promote or sustain improvement, particularly in the area of instruction (2002). Furthermore, the effects of professional development activities, even those that are based at the school site, will be minimal to none if the context in which they function is inadequate to sustain them.

In light of this research, it is apparent that evaluating the impact of technology in a classroom setting is a complex process, and several key factors must be taken into account. It is difficult to measure the impact of technology on student achievement because changes in technology use are often part of larger systemic or network changes. Thus, it is difficult to employ the typical social scientific research methods to infer a simple, causal relationship between technology use and student achievement. Researchers must attempt to capture the constellation of factors and influences that are working congruently with technology use so as to draw that connection (North Central Regional Educational Laboratory, 1999). The research described in this section provides a larger context for this evaluation of MSTP. This research was also used to shape the research questions that were answered during the first year of the MSTP implementation.

Research Questions

The research questions addressed in this report are:

1. To what extent have the MSTP efforts led to the integration of technology standards-based and project-based curricula in mathematics and science classrooms?
2. To what extent did the professional development offered through the MSTP impact teachers' ability to use technology and deliver more standards-based and project-based instruction?
3. To what extent has the infusion of technology in the program schools yielded gains in student performance?

Method

This section presents the methodology employed to evaluate the implementation and effectiveness of the MSTP during the 2003-04 school year. It contains a discussion of the sample selection, data collection, and data analysis procedures. This study employs an experimental design with matched groups of students in a matched treatment group and a control group. The term "treatment group" denotes the schools randomly selected to receive the MSTP technology and support. The term "control group" refers to the set of schools identified with similar characteristics based on the School Characteristics Index (SCI) that did not receive the technology equipment and professional development support offered by the MSTP. The study also contains an additional set of non-matched treatment schools that received the MSTP technology and support. These schools are included in the analyses of program implementation only and analyses are not presented in relation to program impact on student achievement.

Sample Selection

The Program Evaluation and Research Branch (PERB) was asked to identify schools that would represent "typical" middle schools in LAUSD based on their SCI ranking. The SCI is a composite measure of a school's background characteristics developed by the California Department of Education (CDE).[1] The initial stage of the selection procedure consisted of a stratified random selection of schools that have schoolwide Title I programs and mid-range values on the SCI. From a list of 13 schools, which fell into a range of 139.6 to 145.1 (with an overall average of 142.5) on their SCI, eight schools were randomly selected: four schools were selected as matched treatment schools, and four schools were selected as control schools. Then, at the request of program staff, an additional four schools were added to the program treatment efforts. These four schools did not meet the same criteria as the matched treatment and control schools.[2] Thus, these schools were considered

[1] The measure includes both student and school level data. Student level characteristics include student ethnicity, mobility, English proficiency and SES and school level data includes percentage of credentialed teachers and average class size.

[2] The four additional schools fell in the SCI range (137-158.5) with an average of 150.4. An analysis of student language classification and teacher characteristics confirmed that the non-matched treatment teachers were not comparable to the treatment teachers.

"non-matched" treatment schools. The non-matched treatment schools were combined with the matched treatment schools only for the purposes of examining program implementation.

In the second stage of the selection procedure, we randomly selected seven teachers at each of the twelve middle schools: three 6th grade teachers (teaching both core math and science courses), two 7th grade science teachers, and two 7th grade math teachers, for a total of eighty-four teachers. We then randomly selected one class period for each teacher in order to observe classroom practice and test students. Classes were selected based on a class size of at least 20 students, and thus the total number of students in our sample is approximately 1800. Table 1 summarizes the school and teacher sampling procedure.

Table 1: Sample Schools and Number of Teachers by Matched Treatment, Control and Non-Matched Treatment Groups

	Matched Treatment Schools (n=4)	Control Schools (n=4)	Non-Matched Treatment Schools[a] (n=4)
Grade and Subject			
6th/Math/Science	3	3	3
7th/Math	2	2	2
7th/Science	2	2	2
Total/School	7	7	7
Overall Total	28	28	28

a. One teacher from the non-matched schools was removed, therefore the number of non-matched treatment teachers in the final sample was 27.

Student Sampling

We confirmed the comparability of the matched treatment and control students in terms of home language and language classification or English language proficiency using data from the Student Information System (SIS). As shown in Table 2, there were slight differences between matched treatment and control students regarding home language and English Learner (EL) populations. The control group contained proportionately fewer students with a home language of Spanish and had slightly more English Only students. We controlled for these differenced when analyzing the outcome data.

Table 2: Language Classification of Matched Treatment and Control Students

	Matched Treatment		Control	
	6th	7th	6th	7th
Home Language: Spanish	73.9%	65.2%	70.3%	59.5%
Home Language: English	15.8%	23.4%	19.2%	25.6%
Limited English Proficiency	43.1%	24.2%	33.6%	23.5%
English Only	15.8%	23.1%	18.3%	24.2%
Reclassified Fluent English Proficiency	29.2%	42.5%	35.8%	30.1%

In addition to confirming matches in student characteristics between the matched treatment and control groups, we also compared teachers in the two groups for differences in years of experience, employment status, certification and emergency permit classification. Table 3 reveals that control group teachers had more years of experience and were more likely to be fully credentialed teachers than the matched treatment teachers. Conversely, matched treatment teachers were more likely to be interns, or have probationary, provisional or emergency credentials than control group teachers. (See Appendix A for Student Classification and Teacher Characteristics for Non-Matched Treatment.)

Table 3: Matched Treatment and Control Teacher Characteristics

	Matched Treatment (n = 28)	Control (n = 28)
Employment Status		
Continuing	46%	82%
Probationary	25%	14%
Intern	14%	0%
Provisional	4%	4%
Emergency Credential	11%	0%
Years of Experience (mean)	7.9	12.1

Data Collection

Classroom Observations

The principal method used to collect data related to the implementation of the MSTP and teachers' use of technology was observation. Trained research assistants observed each sample teacher for one class period (ranging from 40 to 60 minutes) for three consecutive days (both fall and spring). The observation protocol captured the following dimensions of instruction: quality of the lesson goals, alignment of goals and lesson activities, challenge of the lesson, quality of discussion and quality of teacher and student interaction. The classroom observation instruments were based on a protocol created by UCLA's National Center for Research on Evaluation, Standards and Student Testing (CRESST). The instruments utilized in the observation included:

- Pre-Observation Questionnaire
- Observation Checklist
- Fieldnotes

a. *Pre-Observation Questionnaire:* Prior to the lesson, observers asked the teacher about the goals of the lesson (the skills to be taught) and how these skills would be assessed (during the lesson or at a later date).

b. *Observation Checklist:* The checklist was designed to capture qualities and dimensions of mathematics and science classrooms that shaped the kind of learning environments afforded to students. These qualities and dimensions include: teacher activities and the role of the teacher in facilitating the lesson (e.g., use of questioning strategies), student activities (the nature of the learning tasks), resources in use and tools available to students, and instructional strategies/student groupings or the social culture of the classroom.

c. *Fieldnotes*: Fieldnotes are defined as a written narrative describing in concrete terms and great detail the duration and nature of the activities and interactions observed. Classroom observers documented the nature of the classroom tasks, the instructional strategies used by teachers, the questions asked by teacher and students, the level of discussion, the materials used, and the students' behavior during the class lesson. In addition to field notes, observers collected examples worksheets and other supplemental materials. Within the field notes observers were asked to give a detailed

description of the layout of the room and the resources visible, whether old or new, as well as the seating arrangement of students.

Interviews

In addition to the classroom observations, data collectors conducted interviews with teachers and coaches in our sample as well as principals and technology coordinators from the schools in our study. Through these interviews, we sought to identify issues regarding program implementation, as well as the extent and quality of MSTP professional development services offered.

a. *Teacher Interviews*: Data collectors conducted teacher interviews at the end of the school year at the matched treatment, control, and non-matched treatment schools to identify teachers' technology use, their access to curricular resource material and technology, and their comfort level using technology.

b. *Coach Interview*s: Coaches were interviewed on a monthly basis in order to identify the extent of their work and to determine the degree of consistency in the delivery of site-based professional development available to teachers in the matched treatment schools.

c. *Principal Interviews:* We interviewed principals to identify issues of access, procurement and connectivity that may affect teachers' abilities to integrate technology in the classroom.

d. *Technology Coordinator Interviews*: In schools where technology coordinators were available, we conducted interviews that consisted of identifying their role at their schools and their role in supporting the teachers involved in the MSTP.

Shadowing and Site Visits

In addition to classroom observations and interviews, we observed some of the off-site and the site-based professional development to determine the extent, type and quality of professional development offered to teachers, the number of teachers attending, and the degree of assistance provided to teachers to integrate technology resources and instructional materials into their curricula.

Student Data

We collected student achievement data for the California Standards Test (CST) and the California Achievement Test 6th Edition (CAT/6) in mathematics. At the request of program staff, we also administered a performance-based assessment in mathematics classrooms in order to assess the extent to which students had increased their ability to engage in project-based activities. As there currently is no state testing requirement for science, we chose to administer a science performance assessment to measure the effectiveness of the MSTP in science classrooms. The assessments selected and administered were the Balanced Assessment in Mathematics (BAM) and the Partnership for the Assessment of Standards-based Science (PASS). These performance assessments were administered in both 6th and 7th grade and were used as pre and posttests in mathematics and science. Data collectors were trained to administer the tests. Test administration took place during one randomly selected class period in each sample teacher's schedule. Tests were administered to the whole class with the teacher present in the room.

Balanced Assessment in Mathematics (BAM)

The Balanced Assessment in Mathematics (BAM) is a product published by McGraw Hill and is aligned with the California Content Standards. This assessment was designed by the Mathematics Assessment Resource Service (MARS) under the direction of a Mathematics Board of national and international experts in mathematics education. The emphasis of the assessment is to assess student performance on worthwhile tasks involving practical contexts and substantial chains of reasoning. The standards for the BAM are based on the Principles and Standards for School Mathematics, developed by the National Council of Teachers of Mathematics (NCTM). The test addresses the same content (Number and Operations, Algebra, Geometry, Measurement, Data Analysis and Probability) and process (Problem Solving, Reasoning and Proof, Representation, Connections and Communication) standards for each grade level, increasing in complexity as the student advances across grade levels. The BAM is built from a number of non-routine tasks, usually involving the student choosing and using appropriately a variety of skills and concepts.

Each test consists of two 40-minute parts (A and B), which constitute a well-balanced assessment. Each section of the test is comprised of five separate tasks incorporating each of the standards listed above. These tasks require students to integrate their skills using longer

chains of reasoning and greater depth of knowledge. Students are asked to explain their answers and are given points for showing their work. Part B of the test has one short answer task, which doesn't require students to justify their reasoning. Form B is designed to complement Form A, sampling other areas in addition to the "big ideas" of mathematics at each grade level. BAM has established cut scores for performance divided into four levels, equally distributed on a scale from 1 through 40.

Partnership for the Assessment of Standards Based Science (PASS)

PASS is a standards-based science assessment published by WestEd for elementary, middle and secondary levels. It is aligned to the National Science Standards and the Benchmarks for Science Literacy. The PASS assessment is made up of three components: 1) Enhanced Multiple Choice, 2) Hands-On Performance Task, and 3) Open-Ended Questions or Constructed Response Investigations. The description and rationale for each component are listed below. The questions on the multiple choice component assess students' understanding of important scientific facts, concepts, principles, laws and theories and probe analytical reasoning skills. The tests are written into two alternate and interchangeable forms (1 and 2) and each form contains twenty-nine items. A matrix approach is used to sample across students and content standards. The hands-on performance tasks provide students the opportunity to construct the "big ideas" of science through inquiry and investigation. These tasks are presented to students with a scenario or story line that identifies a problem to solve in the investigation. Students are provided with equipment and materials and are asked to: perform short experiments, communicate scientific information, make scientific observations, generate and record data and analyze their results based on this data. The Open-Ended Questions and Constructed Response questions provide students with a problem and are similar to the performance tasks but do not require hands-on materials. These questions explore students' ability to analyze a problem, communicate scientific information, revise a hypothesis and recommend solutions.

PASS modified their current available test aligned to the National Science Standards for grades five, eight and ten to the California Content Standards for grade levels six and seven so that they could be used in this study. Within each grade level, there are 35 key science concepts and PASS has guaranteed an 86% alignment of the test we administered for both grade levels.

Data Analysis

Qualitative and quantitative data reduction and analysis were conducted with each type of data collected. First, we worked with a team of trained analysts to examine the quality of mathematics and science pedagogy in the fall and in the spring. We focused our analysis of classroom instruction on the extent and quality of activities conducted in mathematics and science classrooms. In addition, we used classroom observation data to determine the resources and materials used and the amount of actual class time devoted to particular instructional activities.

In addition to classroom observation data, we analyzed teacher interview data to determine the frequency of use by matched treatment and non-matched treatment teachers of the technology and electronic curricular resource materials provided as part of MSTP. In addition, we attempted to identify issues regarding program implementation that may have influenced the effectiveness of the program. We also examined the control teacher interview data to determine whether they had access to similar technologies and if they made use of them during instruction. Coach interviews were analyzed to determine the factors influencing the on-site professional development provided to program teachers. We also analyzed principal interview data to identify organizational differences or qualities of leadership or support that may have impacted the program.

In order to determine program effectiveness, we conducted a variety of statistical analyses, including analysis of variance.

The next section presents the findings for the first year of MSTP implementation. The findings are presented first in terms of program implementation, second in relation to the professional development provided to program teachers, and finally, in terms of the impact program implementation had on student achievement.

Findings

Research Question 1: To what extent have the MSTP efforts led to the integration of technology into standards-based and project-based math and science instruction?

In order to determine the extent to which the MSTP was implemented in its first year, we examined classroom observation data collected from all of our sample classrooms (matched treatment, non-matched treatment, and control). The first aspect of implementation examined was whether program teachers used the supplemental curricular resources and tools that were part of MSTP. As part of this analysis, we compared matched treatment and non-matched treatment teachers' activities to those of control teachers' to determine whether technology use was more prevalent in program classrooms. The second aspect examined was whether these resources and technology were used as teaching and learning tools to deliver standards-based and/or project-based curricula in terms of both content and the process skills. Again, we compared program teachers to control teachers to determine whether program teachers were more likely to use technology in order to provide standards-based and/or project-based curricula than their control teacher counterparts. We present the findings for mathematics classrooms first, followed by science classrooms.

Technology Use

First we examined observations of matched treatment and non-matched treatment mathematics classroom to determine if there were changes in MSTP-specific technology use from fall to spring. We aggregated the three days of observation data for each teacher in order to determine the frequency of use for each resource or tool and the average amount of time spent using it. The categories listed below in Tables 4 and 5 were those we found with the greatest frequency in program classrooms.

Table 4: MSTP Technology Use by Matched Treatment and Non-Matched Mathematics Teachers

Resources/Materials	Fall			Spring		
	Never	1 Day	2 or More Days	Never	1 Day	2 or More Days
Internet/website						
Matched Treatment	100	0	0	90	10	0
Non-matched Treatment	100	0	0	80	15	5
Activboard						
Matched Treatment	100	0	0	35	20	45
Non-matched Treatment	100	0	0	35	5	60
Slate						
Matched Treatment	100	0	0	100	0	0
Non-matched Treatment	100	0	0	90	5	5
Student laptops						
Matched Treatment	100	0	0	90	10	0
Non-matched Treatment	100	0	0	85	15	0

As Table 4 reveals, consistent with our expectations, teachers did not use any of the technology associated with the MSTP in fall. This was because teachers had only received some of the technology at the time of the observations and none of the training associated with how they should be used. Yet, as the second half of the table shows, the vast majority of teachers did not use the technology they had received as part of the program in spring. The only technology that appeared to be used frequently was the Activboard, with 65% of matched treatment and non-matched treatment teachers using it on at least one day of observation. In fact, as Activboard use increased, chalkboard and/or overhead usage fell across classrooms. On the other hand, we found that only 5% of the teachers engaged their students in Internet research or activities involving solving computational problems using the Internet. Similarly, we observed no matched treatment teachers and only 10% of the non-matched treatment teachers using the slates. When interviewed, 80% of these teachers

indicated that they had either never used the slates (43%) or had only tried to use the slates once (37%).

There were a number of MSTP provided components that were rarely or never observed being used by these mathematics teachers. These included the probeware, printers, scanners, cameras, and the electronic curricular materials. Teacher observation data was confirmed by teacher interview data. Teachers stated that they rarely or never used probeware (42%), the printers (60%), the scanners (52%), or the cameras (47%). There were a variety of reasons offered by teachers to explain their lack of technology and/or the electronic curricular material use in the spring. For example, two schools never received printers. The cameras and scanners were not delivered to any of the program schools until mid-April. In addition, in half of the schools approximately 15% of the teachers experienced thefts. These thefts included stolen student laptops, projectors, airports, and probeware. In a few of these schools, more than one teacher was impacted by a succession of thefts. Some of the other reasons given by program teachers included a lack of modeling by coaches or others of how to integrate the technologies into lessons (36%), inadequate support from the coaches (30%), and insufficient or inadequate training (33%). Two of the program schools also did not have a full- or even part-time technology coordinator, and thus teachers at those schools had less tech support as there was no site-based person available on a regular basis. Teachers also indicated that they had Internet connection problems, laptop battery longevity problems and malfunctions, software upgrade incompatibilities, printer connection problems, and problems with the camera batteries. Teachers also indicated that the technologies were more suited to the science curriculum. Finally, teachers stated that they did not use the electronic curricular materials because they lacked familiarity with them, adequate training, and the time to explore the materials provided.

In addition to the fact that there was very low usage of any of the technologies provided to the program teachers, observations in the control classrooms revealed that control teachers had access to some of the same, or very similar types of tools and equipment. Control teachers (10%) were observed having their students use laptops during instruction to make presentations. Similarly, one control teacher had her students use laptops to access the Internet during instruction. Thus, except for the use of the Activboard, program

teachers and control teachers provided very similar levels of technology access to their students.

In science, as expected, we found no use of any of the technology in the fall but unlike in mathematics, in the spring we found significant increases in the usage of the Internet by matched treatment teachers (35%) and non-matched treatment (60%) teachers. We also found that 65% of matched treatment and 94% of non-matched treatment teachers were using the Activboard with some frequency. This finding was consistent with the interview data collected. When we asked teachers, 53% of matched treatment and non-matched treatment teachers reported using the Activboard on a daily basis. And finally, we did observe 40% of the matched treatment and 43% of the non-matched treatment teachers use the student laptops during instruction on at least one day of our observations.

Table 5: MSTP Technology Use by Matched Treatment and Non-Matched Treatment Science Teachers

Resources/Materials	Fall			Spring		
	Never	1 Day	2 or More Days	Never	1 Day	2 or More Days
Internet/website						
Matched Treatment	95	5	0	65	15	20
Non-matched Treatment	95	5	0	40	30	30
Activboard						
Matched Treatment	100	0	0	35	25	40
Non-matched Treatment	100	0	0	6	11	83
Slate						
Matched Treatment	100	0	0	95	5	0
Non-matched Treatment	100	0	0	95	5	0
Student laptops						
Matched Treatment	95	5	0	65	15	25
Non-matched Treatment				57	16	27

Interestingly, we found that non-matched treatment science teachers tended to use the technologies provided to them with greater frequency than the matched treatment teachers. This was true in terms of the use of the Internet and the Activboard. One of the possible explanations for these differences is the amount of time the coaches spent at non-matched treatment versus matched treatment schools. As will be discussed in greater detail below,

coaches spent more time working with non-matched treatment teachers than they did with matched treatment teachers.

While there was greater use of the MSTP technologies in the science classrooms, science teachers did report the same problems identified by the mathematics teachers. Program teachers did not receive some of the technologies at all during the school year. Other teachers received materials too late in the school year to be expected to learn to integrate them into their instruction. Science teachers also experienced thefts, and expressed the same lack of sufficient coach support, lack of adequate training, Internet connection difficulties, laptop battery life issues and laptop malfunctions, software upgrade incompatibilities, printer connections, and problems with camera battery life as those expressed by the MSTP mathematics teachers.

Similar to the findings for mathematics teachers in the control schools, we found that science teachers in the control group had and used computers in the classroom. We found Internet research to be an activity that occurred in 10% of the control classrooms. Consequently, there was little difference between program and control classrooms in terms of the use of technology during instruction.

Instructional Activities During Mathematics and Science

In addition to examining the extent to which program teachers used technology provided by MSTP during their instruction, we also examined whether teachers used the technology to provide standards-based and/or project-based curricula to their students. While we did find that teachers' use of technology increased slightly in the matched treatment and non-matched treatment classrooms, we did not find that they used technology more frequently than the control teachers nor did we find that the use of technology led to the provision of more standards-based curricula or to an increase in project-based learning by students. Instead, teachers in all three groups tended to use the technology to provide the same curricula they would have provided without the technology. Additionally, the presence of the technology did not increase the quality of the learning experience for students. We present the mathematics findings first and then the science findings.

As shown in Table 6, matched treatment, non-matched teachers and control teachers were all more likely to demonstrate computational problems on the board and ask their students basic short, closed-ended recall questions than they were to engage their students in

problem solving using real-world applications. This pattern remained true from fall to spring with even a slight increase in the prevalence of recall questions in the spring. In fact, 80% of matched treatment, 85% of non-matched treatment, and 70% of control teachers had their students engage in computational questions calling for basic recall responses, while only 15% of matched treatment and 10% of both control and non-matched treatment teachers had their students engage in problem solving using real-world mathematics applications in the spring. In addition, there was almost no discussion present in any of the three groups of classrooms in the fall and absolutely no discussion took place during the observations conducted in the spring.

Table 6: Instructional Activities by Matched Treatment, Control, and Non-matched Treatment Mathematics Teachers

Resources/Materials	Fall			Spring		
	Never	1 Day	2 or More Days	Never	1 Day	2 or More Days
Recall Questions						
Matched Treatment	40	15	45	20	20	60
Control	25	30	45	30	25	45
Non-matched Treatment	20	20	60	15	20	65
Problem Solving						
Matched Teatment	70	15	15	85	10	5
Control	75	15	10	90	10	0
Non-matched Treatment	80	10	10	90	5	5
Worksheets						
Matched treatment	30	25	45	60	30	10
Control	75	15	10	60	30	10
Non-matched Treatment	60	35	5	70	25	5
Discussion						
Matched Treatment	100	0	0	0	0	0
Control	95	5	0	100	0	0
Non-matched Treatment	100	0	0	100	0	0

Here is an example of the type of lesson we saw most frequently in mathematics classrooms, in which the teacher demonstrates computational problems on the board using recall-questioning strategies:

Teacher: Please be quiet, get your books out, take your seats. Open up to page 85, it's on the board, you're reading page 85.

[Students cluster in back of the room while getting their mathematics books from the book case.The assignment is written on the board: Read p. 85-87. Do # 1-10.]

Teacher: I will give you a few minutes to read then attempt the problems and then we will begin today's lesson. [Students open books and read quietly. All students on task.

[Teacher goes to board and writes: + - x /. Class is silent while all students are on task. Teacher circulates and looks as students work.]

Student: Do we write out whole equation?

Teacher: No I won't ask you to do that. See this part right here. Write that out in your answer. [Teacher moves to the front of the room.]

Teacher: We've gone over a number of things, we've leaned some things about Order of Operations. How do we remember that?

Students: Please Excuse My Dear Aunt Sally.

Teacher: We talked about if we are multiplying opposite signs, what is the answer going to be?

Student: Divide.

Teacher: If we are dividing opposites, what is the answer?

Student: Multiply.

Teacher: If we combine like terms. [Teacher writes and speaks]: 2a + 2b + 2c. Think about dumping fruit on the floor then putting different fruit in different baskets. This is combining like terms. Distributing properties?

[Teacher shows example on board.]

Teacher: If I have an apple [writes and speaks] apple, cake, pie, cookies, ice cream and I combine it with cake what will I have?

Students: Apple cake.

Teacher: Pie?

Students: Apple pie.

Teacher: Cookies?

Students: Apple cookies.

Teacher: Ice cream?

Students: Apple Ice cream. [Teacher draws arrow from apple to all the items in parentheses.]

Teacher: This is distributive properties.

Teacher: Writes and speaks: a (b + c + d + e + f) = ab + ac + ad + ae + af. This is how we get rid of those parenthesis. Why are we learning this? Because every thing we learn is to help us solve bigger, more complicated equations. [Teacher writes and speaks]: 3 + 2 (a + 4) = 28. How many think they can solve this? [Six students raise hands.]

Teacher: Where are we going to start?

Student: In the ( ).

Teacher: Why? Because of Order of Operations.

[And the lesson continues in that manner.]

Had teachers been engaging their students in more standards-based or more project-based curricula, we would have expected to see a large number of classrooms with activities such as the following one taking place:

[The teacher calls two students to the front of the room to read from the board: On January 1, 2003, 1:30 AM, Eva broke into Disneyland and screamed, "Mickey Mouse!" She woke up the mouse family and Mr. Scrooge, Disney's CEO, had her arrested for disturbing the peace. She will be incarcerated in the Haunted House mansion until she says "sorry Mickey" 10,000,000,000 times. She can only stop for eating and sleeping. She must also stop to scrub the mansion for a minimum of 3 hours a day. When will she be able to leave Disneyland? When (date and time) and how long (days, months, etc.)?]

Teacher: What information did I not give you?

Student: How long she stops for eating and sleeping?

Teacher: Right. So will everyone have the same answer? [A couple of students say "no!" Every student, except one boy is looking attentively at the teacher. A student raises his hand.]

Teacher: Yes?

Student: Isn't she gonna go to the bathroom?

Teacher: Good question but she cannot stop saying what?

Students: Sorry Mickey!

Teacher: Right. So when can she stop?

Student: Eating and sleeping?

Teacher: When else? Read the board. Everybody.

Students: She must also stop to scrub the mansion for a minimum of 3 hours a day.

Teacher: Okay. SOLO time. Ready, go!

[Students engage in the problem solving activity. All students are opening up notebooks and reading off board or copying off the board. One boy is saying "Sorry Mickey" quietly to himself while a student is timing him with her watch. Everyone else is working quietly. Teacher circulates and checks student work.]

Teacher: What do you need to determine the formula?

[After a few minutes of having the students attempt to solve the problem individually, she has them pair up.]

Teacher: Okay, boys and girls, whether you're finished or not. It's PARTNER time. 1, 2, 3 . . . all eyes on me. Carl, can you tell us what we have to do during partner time?

Student: Work with a partner to solve the problem.

Teacher: What if your partner has a different answer?

Student: Work on deciding who's right.

Teacher: What if you just don't agree

[The students work in partners for a portion of the class period and then present to the class their answers and the students debate the credibility of their answers.]

The above example was one of the rare instances where a mathematics teacher engaged her students in a problem-solving activity. Instead, more typically we observed significant amounts of time being dedicated to warm-up activities where students worked independently to solve problems from the board. Students also spent an average of 20% of their science class time engaging in rotating oral reading. We also found that teachers in all

three groups spent large amounts of time having their students review their mathematics textbook by reading them and asking their students recall questions.

Where program teachers did use technology during instruction, they were more likely to use technology for the sake of using it as opposed to advancing any conceptual understanding as a result of the technology use. For example, as mentioned earlier, program teachers did use the Activboard more frequently than any other technology. Yet they used the Activboard simply to take the place of the overhead projector or the chalkboard. Here is an example from an MSTP teacher's classroom that illustrates how teachers incorporated technology into student presentations.

Teacher: Ok, what I want to do today is show you what's going to be on your next PowerPoint presentation. Tina and Michelle did a wonderful job, but Marco and Aaron wanted to take it a step further. The came in during period 6 and enhanced it. To get a minimum of a B on your next presentation, it's got to be as good as this. I'm going to talk about what it has after. The only difference is that they speak about every slide. You're going to look at it and then we'll talk. The key to the whole presentation is the transitions. So I'm going to show you. We don't have to say anything about it until afterward. [Teacher starts PowerPoint projections onto the Activboard in the front of the room. The title of the project is, *6th Grade Oceanography Project*. The music playing on the presentation is *Under the Sea* from the Little Mermaid. The first slide is titled *Job Description*:]

Teacher: Here's what they do-bio oceanographers study different types of Marine life. [The next slide is called Art Gallery and has several pictures of marine life. The PowerPoint has fade in/fade out transitions. There is a pre-recorded track of the students talking about each slide that goes along with the presentation. The next slide is called *Typical Work Activities*, and lists just that. The background of the slides is water and fish. The next slide is *What they Discovered over the Years*, and then *Did you know?* and *How they Changed History*. The *Interesting Facts* slide plays the theme song from Gilligan's Island. Finally, the concluding slide is called *Wonders of the Ocean*. Slide show ends.]

Teacher: That's what they did and that's what I'll expect you to do.

Student: Are you going to teach us?

Teacher: I'll show you some thing. This big thing is everything they added either came from slide show or insert. Under slideshow, you want custom animation. The effects are order and timing. In "effects," you can use the way they're coming in and sound. That was all done through custom animation. If you want to insert sound, first you go to put it into the computer. They wanted to insert a movie sounds so they recorded the sound. We used the mike. What they did is download clips onto the desktop, put the mike to the speaker and recorded it as long as they wanted it. Notice here, there's *Beauty and the Beast*. They had the whole song, but they didn't want it. They put the mike up and recorded 30-45 seconds. You just got to make sure the sound bites are legal. But, there is one mistake. Does anyone know?

[Only one screen is done properly. I'm looking at the screen on the left.]

Teacher: Which one is done properly?

[On the left of the screen is the list of the slides. The only slide that shows the text as well as the title is the third one down.]

Student: Number three.

Teacher: The others are blank slides. When you go to present, if you pick the blank title only, nothing shows on the left hand side. I don't like that. I'm going to do it this way, I want to do the title slide, click here, go, ok. I'm going to title this *Our School's Culmination*. You can put other things down here and then I hit enter. [Teacher opens a new file in PowerPoint and builds a couple of slides to show students how presentation should be done.] Then insert, new slide. Maybe I'm going to do test and a picture, so I go here. That title can say Graduates, and now I want to do a picture. You can download one or do this from clip art. Now you notice on each screen you . . . now this is the key. Custom animation. The title is first. The text you enter is second. So I don't have to keep worrying about mouse clicks. The nice thing, if you want to do a picture and text, let's say I type in *Rain in Spain* and then *Snow in Joe* and then the *Hail in Vale*. So now, since it's a bullet, you can run each

individually. If you don't want to do it this way, and put it all as one, you can't do it. Not only am I going to look at content, but I still want to see how well you can use the PowerPoint so you're an expert. So now let's make comments. Maria?

Student: There were two slides with no background.

Teacher: It was a blank background. The background we originally had didn't work. We changed the background to blank and it worked.

Student: I couldn't see the yellow text.

Teacher: So the two blank screens were used on the pictures. What else, good or bad?

Student: I liked the moving pictures.

Teacher: With a MAC, it's easy. You can download animation just like music. It's really easy to do other ways, but that's an easy way. How about the speakers?

Student: Some of it was too loud and some was too soft.

Teacher: That was a problem. Mike spoke lightly, Kelsey was better . . . be careful and play with the sound.

Teacher: I have only one mike and it costs fifty dollars. I'll pass it around to the groups. You're going to have to decide on the music and talk on two screens. The only reason I had them do the talking was so that they wouldn't have to get up in front of an audience. The kids seemed to like it. One teacher told me this was very professional. It's different, but it shows you know it better if you speak. After we finish the CAT test, we have 5 weeks left of school. The final five weeks is a good time or a bad time, and it's you're determination. You're behavior of how you act starting a week from next Thursday. If you behave, it's computers almost daily. I'm going to depend you. Otherwise, you're stuck with a 5000-word essay. It's very quiet in here when we're all working on an essay. So, it's going to depend on you, a really good time versus a really bad time. I'll get across the material in a good way or a bad way.

This example demonstrates the enthusiasm and excitement by the teacher and the students regarding using the technology in the classroom but does not exemplify an integrated use of technology in a standards-based curriculum.

As Table 7 demonstrates, the types of activities found in the science classrooms were very similar to those found in the mathematics classrooms.

Table 7: Instructional Activities by Matched Treatment, Control, and Non-Matched Treatment Science Teachers

Resources/Materials	Fall			Spring		
	Never	1 Day	2 or More Days	Never	1 Day	2 or More Days
Recap Text Using Recall Questions						
Matched Treatment	65	5	30	75	20	5
Control	40	20	40	65	25	10
Non-matched Treatment	38	26	36	80	20	0
Hands-on Lab						
Matched Treatment	75	25	0	65	20	15
Control	65	25	10	70	20	10
Non-matched Treatment	68	21	11	65	15	20
Worksheets						
Matched Treatment	35	15	50	75	20	5
Control	50	20	30	75	20	5
Non-matched Treatment	60	15	15	60	15	15
Student Presentations						
Matched Treatment	85	10	5	85	15	0
Control	95	0	5	75	20	5
Non-matched Treatment	95	5	0	85	15	0
Discussion						
Matched Treatment	85	15	0	100	0	0
Control	85	10	5	90	10	0
Non-Matched Treatment	69	16	15	100	0	0

As shown in Table 7, matched treatment, non-matched teachers, and control teachers were all just as likely to have their students read from the textbook and answer basic short,

closed-ended recall questions as they were to engage their students in hands-on lab activities. This pattern remained true from fall to spring. There was a decrease from fall to spring in the percentage of teachers who had their students use worksheets. For matched treatment (35%) and non-matched treatment (35%) teachers there was also a slight increase in the percentage of teachers who had their students engage in hands-on lab activities. Control teachers, on the other hand, decreased their use of hands-on activities in the spring. In addition, while there had been engagement of students in discussion in the fall, only control teachers classrooms were observed engaging their students in discussion in the spring.

Program teachers did not integrate technology into their instructional practices in the ways anticipated by the program. They did not make use of the technologies or the electronic curricular materials on a regular basis and did not use them to provide more standards-based or project-based curricula to their students. Some of the reasons for the low levels of implementation included the late roll out of the materials, failure to attend trainings, insufficient coach support, insufficient training, insufficient time to explore the capacity of these new tools, and theft of some of the tools. In addition, control classrooms had access to some of the very same technological resources as the program schools. The control teachers used these resources in similar, if not more sophisticated ways as their program teacher counterparts. As a result, there was not a significant difference in the use of technology in program and control classrooms. Moreover, teachers in all groups tended to use technology in similar ways. They relied on instructional activities that called for basic-recall responses to closed-ended questions, reading from the textbook, and very little engagement of students in discussion or hands-on activities. In fact, in both mathematics and science classrooms, we found very few opportunities for students to engage in thoughtful discourse and recognize relationships among ideas, or have opportunities to think critically and to develop explanations, make predictions or debate alternative approaches to problems.

Research Question 2: To what extent did the professional development offered through the MSTP impact teachers' ability to use technology during instruction?

During the first year, professional development provided to the program schools consisted of formal "off-site" trainings and site-based coaching. The off-site trainings were

meant to introduce teachers to the equipment and electronic resource materials that comprised the MSTP. The coaching was intended to provide teachers with assistance in integrating the technology into their classroom instruction.

The off-site trainings teachers received were primarily introductions to the technical aspects of the equipment or electronic resource materials the teachers received. All but one of these trainings took place as one-day workshops. Additionally the trainings devoted very little time to how to utilize these tools to develop lessons focused on problem-solving or project-based learning or how to integrate the technologies provided to teachers into the curriculum. The trainings were conducted on Saturdays and usually lasted for eight hours. Attendance at these trainings was inconsistent across program schools, with some program schools not represented at all. Six of the schools averaged between 40% to 50% teacher attendance at most of the trainings, and two of the schools averaged closer to 70% attendance at these trainings. The only trainings which all teachers attended were the orientations where teachers were given their personal laptops and were introduced to the Activboard and its software. At the close of the school year, teachers were offered a more intensive workshop lasting two days, which gave them an opportunity to explore some of the electronic curricular resources with greater depth than the previous trainings. Less than 50% of the program teachers attended at least one day of the two-day training. This training gave those who attended an opportunity to jointly plan lessons to be used in the following academic year across schools, grade levels and content areas. Overall, teachers did not take advantage of the trainings offered to them to be introduced to the technologies that they had been given as part of the program. It is possible that teachers failed to attend because each training was provided only once on a specific Saturday and teachers may not have been able to attend due to other commitments. Limited make-up training opportunities were provided.

Site-Based Support

Eight coaches were hired to provide informal site-based support on a regular basis throughout the year. Coaches were hired based on their expertise in either mathematics or science and based on years of experience teaching (ranging from 10-32 years). Not all coaches were chosen based on their prior experience with technological instructional materials or experience coaching. In fact, few of the coaches had prior experience coaching. Coaches were allotted 12 days of training throughout the course of the two-year grant, which

consisted of both training with the equipment and coach/mentoring training. Coaches were expected to provide training to the program teachers, introduce some of the curricular resource materials to the whole school, and ensure that the majority of teachers at the program schools completed the (California Technology Assistance Project) CTAP surveys for teacher and student technology proficiencies.

The coaching model adopted by the MSTP paired two coaches together to work at two schools at a time. There were three rotations (9 weeks, 11 weeks, and 15 weeks). Coaches were assigned to different partners and different schools during each rotation. During a given week, coaches were expected to divide their time between their two assigned schools, visit the school either with their partner coach or separately, and engage in a variety of other program related activities that did not take place at the program schools. Coaching activities varied based on the rotation, the roll out of the equipment, and other program needs.[3]

During the first year of program implementation, the majority of coach time was spent on a wide range of activities that competed for the coaches' time. These activities included: their own formal trainings, attending program related staff meetings, spending time learning to use the equipment and electronic resources, researching websites in order to find suggestions to offer to teachers, writing reports or additional grants, and providing site-based support to two schools per rotation. At the school sites, coaches spent most of their time providing teachers with technical support in setting up their equipment, addressing a variety of networking and security issues, and/or getting teachers to access the CTAP surveys. In addition to the challenges posed by having so many different responsibilities that took up so much of the coaches' time, when they did seek teachers out to provide support there seemed to be two constraints they faced. The first was the approach coaches most commonly used to providing support. Coaches tended to informally "check-in" with a teacher by visiting a teachers' classroom and inquiring whether everything was all right. Because these visits generally occurred while teachers were conducting a lesson, the visits did not usually last more than a few minutes. In fact, when teachers were asked how coaches were able to offer support, teachers admitted that they provided moral support and would "check in on us to

[3] Six of the program schools received the bulk of their equipment in late November to mid-December. The two multi-track schools did not receive their equipment until March when the A-track teachers returned from their winter break.

make sure everything was alright." A separate but equally important issue coaches faced was the lack of teachers' time to meet to discuss and work directly with teachers. Coaches typically found teachers' conference periods as the only time available, and during that time, teachers frequently had numerous priorities that took precedence over working directly with the coaches. In most cases, coaches found limited opportunities to schedule site-based professional development workshops or an opportunity for the cohort of teachers to meet at the school site on any regular basis. Perhaps as a result of the coaches' typical approach to providing support and because of the teachers' lack of time outside of class time, 40% percent of program teachers found that the coaches were not able to offer the modeling or provide examples of the lesson integration that they had expected to receive.

In addition to these two issues, a third issue that arose was that the impact the coaching model itself seemed to have on the coaches' abilities to do their jobs. As a consequence of the coaches splitting their time between two schools and the periodic rotations and coach reassignments, 19% of the teachers characterized the coaches as inconsistent in their approach to coaching, in their availability, and their presence at the school sites. When teachers were asked if they felt the coaches were available to offer them support, 18% indicated that they had such inconsistent schedules that it was difficult to know if they were at the school or not, and 15% indicated that they were available but only on a limited basis. Although 36% of the teachers found the coaches to be effective and helpful, even those teachers who found the coaches helpful indicated a desire to have the coaches available on a full-time basis rather than only partially, as their time was split between schools.

Another issue that made it significantly more difficult for the coaches to provide the types of instructional support they were hired to provide was the fact that program participants had different understanding and expectations for the coaches' role. Teachers expressed confusion over the role of the coaches. In fact, 28% of the program teachers thought the coaches were there to offer technical support only. These teachers expressed disappointment that the coaches could not offer more technical support than was made available to them. On the other hand, the coaches found themselves struggling with the challenge of trying to offer instructional support when the teachers contacted them for technical support. Only 38% of the program teachers interviewed interpreted the coaches'

role as one that offered both technical support and assistance with lesson integration. Yet in spite of the difficulties present in the coaching model and the frustration expressed by some teachers in not getting what they expected from the coaches, teachers also expressed empathy and support for the coaches. Teachers understood that the coaches were spread too thin, that they were serving multiple schools at great distances from each other, and that there was an array of meetings or trainings, limiting the time that was available for coaches to meet with teachers.

As demonstrated above, program teachers' use of the technology was impacted by a variety of factors beyond the presence or absence of the technology in the classrooms. In many cases teachers did not attend the training opportunities offered to them and thus their ability to use the technology was hindered. Program teachers also felt they did not have the time to learn how to use the tools or explore ways to use the materials provided in interesting and dynamic ways. Teachers also felt they did not receive the types of coaching support that would have allowed them to use the technology in their instruction. Teachers wanted the coaches to provide more examples of actual lessons aligned to the standards as their time to explore was extremely limited. Coaches on the other hand, were pulled in many different directions as a result of a large number of responsibilities that took up much of their time. These responsibilities combined with their approach to contacting the teachers and the teachers' lack of time outside of class to impact the time available for coaches and teachers to work together. Additionally, the fact that coaches were split between two schools at the same time and were rotated made their work more difficult. And finally, there seemed to be different understandings regarding the coaches' role. Coaches perceived themselves as responsible for facilitating instruction. Teachers sometimes saw the coaches as individuals who could provide technology support. Thus, they were not always in agreement as to how the coaches were intended to serve the teachers' needs.

Research Question 3: To what extent has the infusion of technology in the program schools yielded gains in student performance?

In light of the findings related to program implementation, we examined the extent to which the program had an impact on student achievement. Given the low level of

implementation, we did not expect to see a program impact in this first year. We examined achievement data collected from the BAM, the PASS, the CST, and the CAT/6 using only matched student scores for each test. This section presents the results of our analyses. Findings will be presented first for the matched treatment and control schools and then separately for the non-matched treatment schools.

Balanced Assessment in Mathematics

The BAM was administered to 6th and 7th grade students in mathematics classrooms. Tables 8 and 9 show descriptive statistics of BAM raw pre and posttest scores for matched treatment and control students for grade 6 and grade 7 for both parts of the test (A and B) separately. To statistically test the differences in students' pre and posttest scores, we conducted Analyses of Variance (ANOVAs) using unstandardized residuals of the pre and posttest scores of matched treatment and control students on the BAM for the two sections of the test. In 6th grade, we discovered no statistically significant differences between the 6th grade students who were a part of the MSTP program and 6th grade students who were not part of the program. This was true for both sections of the test. Both groups of students demonstrated fairly equal gains on both sections of the test.

In 7th grade, we found the control group outperformed the matched treatment group on Part B of the assessment only.[4] The matched treatment group's residual score was -1.13, and the control group's residual score was -.108. This difference in students' residual scores was statistically significant at p=.05 using an ANOVA.

Table 8: Pre and Posttest BAM Mean Scores and Adjusted Gains for 6th Grade

	Matched Treatment (N=241)			Control (N= 220)		
Test	Pretest Mean (SD)	Posttest Mean (SD)	Adjusted Gain	Pretest Mean (SD)	Posttest Mean (SD)	Adjusted Gain
BAM Part A	7.7 (5.7)	11.3 (7.3)	.529	12.2 (6.8)	15.7 (7.5)	.546
BAM Part B	7.3 (5.3)	10.9 (7.7)	.503	12.6 (7.2)	16.6 (8.2)	.929

[4] Across both grade levels we found that students overall scored better on Part B of the test. One explanation for this is that one of the Part B tasks only requires students to provide a one-answer response, resembling assessments closer to the norm referenced CAT/6 or the CST.

Table 9: Pre and Posttest BAM Mean Scores and Adjusted Gains for 7th Grade

	Matched Treatment (N=155)			Control (N= 154)		
Test	Pretest Mean (SD)	Posttest Mean (SD)	Adjusted Gain	Pretest Mean (SD)	Posttest Mean (SD)	Adjusted Gain
BAM Part A	5.94 (3.3)	7.9 (4.0)	-1.11	6.85 (3.8)	9.38 (5.1)	-.535
BAM Part B	10.65 (5.8)	12.75 (6.8)	-1.13	9.87 (6.0)	13.08 (6.0)	-.108*

*p=.05

The matched treatment and control groups were considerably different in terms of the composition of their 6th grade students' English language proficiency. Matched treatment schools had higher proportions of Limited English Proficient (LEP) students than control schools. In order to control for differences that might be due to this varying composition between the groups, we isolated the 6th grade LEP students and compared the means of the matched treatment and control students including only LEP students. When we ran an ANOVA using the residuals of BAM scores, including only 6th grade LEP students, again we found a similar pattern as for the larger group. There were no statistically significant differences.

BAM results did not demonstrate any program effect. (See Appendices B-E for performance level change tables.)

Using a linear regression with 2003 CAT/6 Normal Curve Equivalent (NCE) score as the predictor variable and 2004 CAT/6 NCE score as the outcome variable, we computed unstandardized residuals to estimate the gains students made from 2003 to 2004. Next, we conducted an ANOVA to compare the gains of the matched treatment and control groups. The 6th grade matched treatment students outperformed the 6th grade control students. This difference was significant at level p=.01. Table 10 shows these results.

Table 10: 2003 and 2004 CAT/6 Mathematics NCE Unstandardized Residuals for 6th Grade

		Mean	Std Dev.	Adjusted Gain
Matched Treatment (N=238)	2003	49.67	18.18	
	2004	52.15	19.40	2.96*
Control (N= 221)	2003	50.89	21.04	
	2004	49.53	21.42	-.55

**p<.01

In the groups of 7th grade students, no significant differences were found between the control and matched treatment students, as shown in Table 11. Although 7th grade students in the matched treatment group decreased more substantially than the control group in 2004, their mean NCE scores (46.78) were nominally higher than the control students' (46.12). These findings indicate there was no significant program impact.

Table 11: 2003 and 2004 CAT/6 Mathematics NCE Unstandardized Residuals for 7th Grade

		Mean	Std Dev.	Adjusted Gain
Matched Treatment (N=326)	2003	48.11	19.76	
	2004	46.78	17.21	-1.26
Control (N= 387)	2003	46.37	22.02	
	2004	46.12	19.49	-.644

We also examined the CAT/6 data to isolate the 6th grade matched treatment and control LEP students and ran an ANOVA using the residuals of CAT/6 NCE scores and found no statistically significant differences.

We also conducted a linear regression predicting the 2004 CST mathematics scaled score using the 2003 scaled score as the predictor to compute unstandardized residuals. Using these residuals as gain scores, we conducted ANOVAs for 6th and 7th grades separately to compare the performance of the control and matched treatment groups. We found a difference in the gain scores between the 6th grade matched treatment group (M=5.04) and

the 6th grade control group (M=-.98), yet these differences were not found to be statistically significant. The matched treatment group outperformed the control as summarized in Table 12. These differences resemble the differences found in CAT/6 performance among the 6th grade matched treatment students.

Table 12: 2003 and 2004 CST Means and Adjusted Gains for 6th Grade

		Mean Scale Score	Std Dev.	Adjusted Gain
Matched Treatment (N=235)	2003	341.02	63.20	
	2004	339.66	54.65	5.04
Control (N= 220)	2003	351.41	64.7	
	2004	340.88	65.6	-.984

Reverse findings were found among the 7th grade, such that the control group outperformed the matched treatment group on the CST with a residual gain of (2.0) in the control group and (-2.6) in the matched treatment group. These differences were not statistically significant. Again, there was no clear indication of a program effect. (See Appendices F and G for CST performance level change over tables).

Table 13: 2003 and 2004 CST Means and Adjusted Gains for 7th Grade

		Mean Scale Score	Std Dev.	Adjusted Gain
Matched Treatment (N=326)	2003	324.70	46.47	
	2004	323.79	49.30	-2.6
Control (N= 384)	2003	323.25	54.1	
	2004	327.10	59.87	2.0

Similar to the BAM and the CAT/6 analyses that isolated the 6th grade LEP students, we also looked at the CST data of the matched treatment and control groups only including 6th grade LEP students. We found a significant differences within the LEP students' adjusted gain scores which were statistically significant at $p<.05$. The matched treatment group had an

adjusted gain score of –4.19, and the control group had an adjusted gain score of –14.4. This pattern is consistent with what we found in the whole group.

As mentioned previously, there are no state required tests in science. Therefore, the only test data available to us were student outcomes from the PASS. We administered the PASS to both 6th and 7th grade matched treatment and control group students in science classrooms. We examined differences between groups and across grade levels for the pre and posttest of the PASS assessment for only those students taking all three sections of the test. As Table 14 demonstrates, students in both groups scored higher on the performance task section of the assessment in the 6th grade than on any other portion of the test. Students in the control group demonstrated higher scores for the constructed response/open-ended portion of the assessment than the matched treatment students although these differences were not found to be significant. We conducted a linear regression analysis predicting the posttest raw scores for the three sections of the test – the multiple-choice, the performance task, and the constructed response/open-ended section of the assessment – as a function of the pretest. We found that 6th grade matched treatment students outperformed the control students on the performance task. This difference was statistically significant ($p<.05$).

Table 14: Pre and Posttest PASS Mean Scores and Adjusted Gains for 6th Grade

	Matched Treatment (N=317)			Control (N= 261)		
Test	Pretest Mean (SD)	Posttest Mean (SD)	Adjusted Gain	Pretest Mean (SD)	Posttest Mean (SD)	Adjusted Gain
Multiple Choice	53.8 (.10)	57.3(.11)	.063	54.5(.12)	56.8(.13)	-.255
Performance Task	51.1 (.09)	64.0 (.09)	.236	56.93 (.11)	64.7 (.10)	-.236*
Constructed Response	31.9(.08)	36.4(.09)	-.008	32.6(.11)	40.6(.09)	.028

*p<.05

For the 7th grade students, no significant differences were found between the matched treatment and control students on the multiple-choice section of the assessment (see Table 15). The control students outperformed the matched treatment students on the

performance task with an adjusted gain of (-.012) compared to the matched treatment (-.40) although these differences were not statistically significant. The PASS results also indicate no clear program impact.

Table 15: Pre and Posttest PASS Mean Scores and Adjusted Gains for 7th Grade

	Matched Treatment (N=220)			Control (N= 205)		
Test	Pretest Mean (SD)	Posttest Mean (SD)	Adjusted Gain	Pretest Mean (SD)	Posttest Mean (SD)	Adjusted Gain
Multiple Choice	49.6 (.07)	53.5(.11)	.076	49.4(.09)	52.5 (.13)	-.186
Performance Task	47.1 (.07)	47.6 (.12)	-.400	51.8 (.08)	57.5 (.12)	-.012
Constructed Response	26.6 (.10)	35.8 (.11)	-.002	32.6(.11)	40.6 (.09)	-.007

p<.05*

What these findings reveal across all tests is that overall students across both grade levels and groups demonstrated fairly equal gains on these measurements and the results are mixed and fairly inconsistent. As a result, it does not appear that the MSTP had an impact on student achievement in the first year.

Conclusions

The first year of this two-year evaluation provides formative feedback on the implementation of the program during the 2003-04 school year and its relationship to student achievement. The findings addressed three research questions:

1. To what extent have the MSTP efforts led to the integration of technology and into standards-based and project-based curricula in mathematics and science classrooms?
2. To what extent did the professional development offered through the MSTP impact teachers' ability to use technology during instruction?
3. To what extent has the infusion of technology in the program schools yielded gains in student performance?

With respect to question one, we examined program implementation in two ways. First we looked at whether the technology provided to program schools was used by teachers during the school year. We found that teachers did use some of the technology provided by

the program by the spring. Technology was more prevalent in science classrooms than in mathematics classrooms. This finding based on observation data was supported by teacher interview data. Mathematics teachers indicated that they felt the tools and resources were better suited for science instruction and that they experienced more difficulties in incorporating the technology into their lessons than the science teachers. A number of factors including delays in the roll out of the program related equipment and thefts impacted teachers' ability to use the MSTP provided technology. We also saw similar technology being used by control teachers. Thus, there were very few differences in the use of technology between matched treatment and control classrooms.

Second, we analyzed the data to determine whether teachers used the program technology and resources as teaching and learning tools to deliver standards-based and project-based curricula reflective of both the content and the process skills of developing reasoning and problem solving skills. We did not find that teachers used the technology in new and different ways but instead used it to take the place of other methods of instructional delivery (e.g., using the Activboard instead of the overhead projector or blackboard). Consistent with the research on technological reforms in education (Cuban, 2000), most teachers used the technology to maintain existing practices rather than to enhance student development of problem-solving and reasoning skills and the development of student understanding in these subject areas. We also found minimal change in instructional practice reflective of problem solving activities. Instead, teachers continued to engage their students in basic-recall closed-ended questioning, reading their textbooks, and answering questions from the textbooks. We did not see any evidence to suggest that the technology had increased teachers' ability to facilitate more standards-based and project based mathematics and science instruction.

With respect to question two, we examined whether the professional development offered to MSTP teachers had an impact on their ability to use the technology in the delivery of their lessons. We found that many teachers did not attend one or more of the formal trainings offered to program teachers. Not surprisingly, teachers who did not attend the formal trainings in the use of the electronic curricular resources were not likely to use them. Teachers also expressed a desire to have more in-depth trainings. In Year 1, the emphasis of

professional development was on introducing teachers to the MSTP technology for use in their classrooms.

We found inconsistencies in the delivery of site-based support to teachers. The majority of support provided in Year 1 consisted of technical support rather than the modeling and lesson integration teachers were seeking. While 89% of the MSTP teachers expressed enthusiasm to be selected to participate in the program, and felt their participation in the program had a generally positive impact on their experience as a teacher, teachers did not believe they received the training or lesson modeling they needed to assist them in using the technology during instruction. Coaches were tasked with a wide range of duties that took valuable time away from their ability to deliver the site-based instructional support that teachers needed. Additionally, we found that the coaching model of rotating coaches through the eight schools had an impact on coaches' and teachers' ability to develop rapport and an on-going relationship that would have translated into the provision of continuous teacher support.

With respect to the third question, student achievement data provided mixed results. On some tests, matched treatment students outperformed control students. On other tests, the control students outperformed matched treatment students. This held true for both grade levels. Thus, in Year 1, we did not find a program effect. Yet this finding is not surprising given the low levels of program implementation in matched treatment classrooms and the presence of technology in control classrooms.

It is our expectation that we will find greater program impacts in Year 2 of the study.

Recommendations

In light of the above findings, we make the following recommendations to ensure that the program is effectively implemented in Year 2.

Teachers should be provided with additional ongoing, in-depth professional development that not only instructs them about the mechanics of the technology, but also teaches them how to meaningfully integrate it equally across both content areas.

Coaches' time should be spent one-on-one with teachers, modeling lessons, and providing examples of ways to integrate technology into the curriculum. Coaches should deliver a consistent plan across schools and across subject matter such that program teachers receive an equal level of support on a continuous basis.

Program staff should consider targeting professional development opportunities with concrete examples of how to use the technology to teach the curriculum in both mathematics and science, so that teachers don't have to spend their time searching for examples of lessons that integrate the mathematics and science curriculum.

Program staff should consider involving and training the technology coordinators at each of the school sites to provide the technology support necessary to teachers.

Program staff should consider focusing professional development efforts on problem-based learning opportunities for students across both subject areas and enhance the opportunities for site-based formal trainings to ensure greater attendance at each of the school sites.

Program staff should consider providing coaches and MSTP teachers with opportunities to meet with each other on a more regular basis. Similarly, program staff should provide MSTP teachers with opportunities to meet with colleagues across program schools in order to learn from one another and share lessons learned. The addition of technology to the educational program may require adjustments in the professional development opportunities built into the site-based professional development model at the school sites.

In the second year of the evaluation we will continue to examine the extent to which the MSTP is implemented in program classrooms and whether implementation translates into an increase in teachers' ability to provide their students with standards-based and project-based curricula. We will also continue to examine whether program implementation leads to increased student achievement in mathematics and science classrooms.

References

American Association for the Advancement of Science, Benchmarks in Science Literacy, 1989.

Ball, D. L. (1993). With an Eye on the Mathematical Horizon: Dilemmas of Teaching Elementary School Mathematics. The Elementary School Journal, 93 (4). pp. 373-397.

Becker, H., Riel, M. (2000) The Beliefs, Practices, and Computer Use of Teacher Leaders: Paper presented at the American Educational Research Association, New Orleans, April 26, 2000.

Cuban, Larry: Oversold and Underused: Computers in the Classroom, Cambridge, MA: Harvard Press 2001.

Elmore, R. F. (2002) Bridging the gap between standards and achievement. Washington, D.C: Albert Shanker Institute.

Fullan, M. G. (2001) The New Meaning of Educational Change (3rd ed.) New York: Teachers College Press.

Hasselbring, T. S., & Tulbert, B. (1991). Improving education through technology: Barriers and recommendations. *Preventing School Failure*, *35*, (3), 33-37.

Joyce, B., & Showers, B (1988) Student Acheivement through Staff Development. White Plains, NY: Longman Press.

Kinzer, C., & Leu, D. J. (1997). Focus on research—The Challenge of Change: Exploring Literacy and Learning in Electronic Environments. Language Arts, 74, (2), 126-136.

Kosakowski, J. (1998). The Benefits of Information Technology. *ERIC Digest,* EDO-IR-98-94.

Lemke, Cheryl. Coughlin, Edward (1998) Technology in American Schools: Seven Dimensions for Gauging Progress: Publication of the Milken Foundation.

National Council for Teaching of Mathematics Curriculum and Evaluation Standards for Teaching Mathematics, 1989, Professional Standards for Teaching Mathematics, 1991.

North Central Regional Educational Laboratory (1999). Critical Issue: Using Technology to Improve Student Achievement.

Office of Technology Assessment, Teachers and Technology, Making the Connection; 1995

Preskill, H., & Torres, R. T. (1999) Evaluative Inquiry for learning organizations. Thousand Oaks, CA: Sage Publications.

Schacter, John The Impact of Education Technology on Student Achievement: What the Most Current Research Has to Say.

Shulman.L. (1986). Those Who Understand: Knowledge Growth in Teaching. Educational Researcher, 15 (2), 4-14.

Appendices

Appendix A: Non-matched treatment student and teacher characteristics

Language Classification of Non-Matched Treatment Students		
	6th	7th
Home Language: Spanish	56.9%	51.8%
Home Language: English	39.2%	41.5%
Limited English Proficiency	20.8%	16.9%
English Only	38.4%	41.2%
Reclassified Fluent English Proficiency	19.2%	30%

Teacher Characteristics Non Matched Treatment (n=27)	
Employment Status	
Continuing	59.3%
Probationary	11.1%
Intern	3.7%
Provisional	3.7%
Emergency Credential	-
Years of Experience (mean)	9.42

Appendix B: 6th Grade Students Performance Levels on Pre and Posttest Balanced Assessment in Mathematics, Part A

		1	2	3	4	Total	decrease	increase
BAM Treatment A	1	64.8%	29.1%	6.1%	0.0%		0	35.2%
		107	48	10	0	165	0	58
	2	18.8%	42.2%	37.5%	1.6%		18.8%	39.1%
		12	27	24	1	64	12	25
	3	0.0%	16.7%	66.7%	16.7%		16.7%	16.7%
		0	2	8	2	12	2	2
	4	0.0%	0.0%	0.0%	0.0%		0.0%	0.0%
		0	0	0	0	0		
Total		119	77	42	3	241	5.8%	35.3%

		1	2	3	4	Total	decrease	increase
BAM Control A	1	67.3%	28.3%	4.4%	0.0%		0	32.7%
		107	45	7	0	159		52
	2	7.7%	50.0%	40.4%	1.9%		7.7%	42.3%
		4	26	21	1	52	0	22
	3	0.0%	0.0%	55.6%	44.4%		0.0%	44.4%
		0	0	5	4	9	0	4
	4	0.0%	0.0%	0.0%	0.0%	0	0%	0%
		0	0	0	0		0	0
Total		111	71	33	5	220	1.8%	35.5%

Appendix C: 7th Grade Students Performance Levels on Pre and Posttest Balanced Assessment in Mathematics, Part A

		1	2	3	4	Total	decrease	increase
BAM Treatment A	1	80.0% 112	20.0% 28	0.0% 0	0.0% 0	140	0	20.0% 28
	2	30.8% 4	61.5% 8	7.7% 1	0.0% 0	13	30.8% 4	7.7% 1.0%
	3	0.0% 0	100.0% 2	0.0% 0	0.0% 0	2	100.0% 2	0.0% 0
	4	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0	0.0%	0
Total		116	38	1	0	155	3.9%	18.7%

		1	2	3	4	Total	decrease	increase
BAM Control A	1	65.3% 81	31.5% 39	3.2% 4	0.0% 0	124	0	34.7% 43
	2	31.0% 9	51.7% 15	13.8% 4	3.4% 1	29	31.0%	17.2% 34
	3	0.0% 0	0.0% 0	100.0% 1	0.0% 0	1	0.0%	0.0% 0
	4	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0	0.0% 0	0 0
Total		90	54	9	1	154	22.7%	47.4%

Appendix D: 6th Grade Students Performance Levels on Pre and Posttest Balanced Assessment in Mathematics, Part B

		1	2	3	4	Total	decrease	increase
BAM Treatment B	1	48.1%	44.2%	7.7%	0.0%		0	51.9%
		50	46	8	0	104		54
	2	6.3%	50.0%	42.7%	1.0%		6.3%	43.8%
		6	48	41	1	96	6	42
	3	0.0%	13.2%	71.1%	15.8%		13.2%	15.8%
		0	5	27	6	38	5	6
	4	0.0%	0.0%	33.3%	66.7%		33.3%	66.7%
		0	0	1	2	3	1	0
Total		56	99	77	9	241	5.0%	42.3%

		1	2	3	4	Total	decrease	increase
BAM Control B	1	47.7%	45.5%	6.8%	0.0%		0	52.3%
		42	40	6	0	88		46
	2	7.9%	55.1%	33.7%	3.4%		7.9%	37.1%
		7	49	30	3	89	7	33
	3	0.0%	5.0%	60.0%	35.0%		5.0%	35.0%
		0	2	24	14	40	2	14
	4	0.0%	0.0%	0.0%	100.0%		0.0%	0
		0	0	0	3	3	0	0
Total		49	91	60	20	220	4.1%	42.3%

Appendix E: 7th Grade Students Performance Levels on Pre and Posttest Balanced Assessment in Mathematics, Part B

		1	2	3	4	Total	decrease	increase
BAM Treatment B	1	65.7% 46	34.3% 24	0.0% 0	0.0% 0	70	0 0	34.3% 24
	2	14.1% 10	64.8% 46	21.1% 15	0.0% 0	71	14.1% 10	21.1% 15
	3	0.0% 0	28.6% 4	64.3% 9	7.1% 1	14	28.6% 4	7.1% 1
	4	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0	0.0% 0	0.0% 0
Total		56	74	24	1	155	9.0%	25.8%

		1	2	3	4	Total	decrease	increase
BAM Control B	1	55.4% 41	43.2% 32	1.4% 1	0.0% 0	74	0 0	44.6% 33
	2	9.9% 7	69.0% 49	21.1% 15	0.0% 0	71	9.9% 7	21.1% 0
	3	0.0% 0	11.1% 1	77.8% 7	11.1% 1	9	11.1% 1	11.1% 1
	4	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0	0.0% 0	0 0
Total		48	82	23	1	154	5.2%	31.2%

Appendix F. California Standards Test Change Over Table for 6th Matched treatment and Control Students in Mathematics

Grade = 6 Treatment

		2004 Math CST							
		FBB	BB	B	P	A	Total	decrease	increase
2003 Math CST	FBB	18% 3	23% 12	12% 2	0% 0	0% 0	17	0 0	35% 14
	BB	4% 2	38% 20	46% 24	12% 6	0% 0	52	4% 2	58% 30
	B	3% 1	23% 18	47% 33	20% 14	6% 4	70	26% 19	26% 18
	P	1% 0	11% 2	41% 32	47% 37	10% 8	79	12% 34	10% 8
	A	0% 0	0% 0	0% 0	37% 7	63% 12	19	37% 7	0% 19
	Total	6	52	91	64	24	237	26%	38%

Grade = 6 Control

		2004 Math CST							
		FBB	BB	B	P	A	Total	decrease	increase
2003 Math CST	FBB	11% 1	11% 5	33% 3	0% 0	0% 0	9	0 0	44% 8
	BB	2% 6	42% 28	28% 13	0% 0	0% 0	47	2% 6	28% 13
	B	9% 1	22% 16	55% 37	16% 11	3% 2	67	31% 17	19% 13
	P	1% 0	20% 5	28% 21	16% 36	16% 12	74	21% 26	16% 12
	A	0% 0	0% 0	12% 3	28% 7	60% 15	25	40% 10	0% 0
	Total	8	54	77	54	29	222	27%	21%

Appendix G. California Standards Test Change Over Table for 7th Matched treatment and Control Students in Mathematics

Grade = 7 Treatment

		2004 Math CST							
		FBB	BB	B	P	A	Total	decrease	increase
2003 Math CST	FBB	17% 1	83% 5	0% 0	0% 0	0% 0	6	0 0	83% 0
	BB	2% 12	57% 27	17% 8	0% 0	0% 0	47	2% 12	17% 8
	B	18% 3	25% 16	54% 35	17% 11	0% 0	65	43% 19	17% 11
	P	9% 0	0% 0	25% 8	75% 24	0% 0	32	34% 8	0% 0
	A	0% 0	0% 0	0% 0	100% 2	0% 0	2	0% 2	0% 2
	Total	16	48	51	37	0	152	27%	14%

Grade = 7 Control

		2004 Math CST							
		FBB	BB	B	P	A	Total	decrease	increase
2003 Math CST	FBB	38% 3	9% 5	0% 0	0% 0	0% 0	8	0 0	9% 5
	BB	5% 7	54% 31	32% 18	2% 1	0% 0	57	5% 7	33% 19
	B	11% 3	36% 9	46% 28	30% 18	14% 3	61	47% 12	44% 21
	P	0% 0	0% 0	20% 5	24% 14	24% 6	25	20% 5	24% 6
	A	0% 0	0% 0	0% 0	100% 1	0% 0	1	0% 1	0% 1
	Total	13	45	51	34	9	152	16%	31%