SOLIDIFYING THE GAINS:

METROLINC YEAR 4 EVALUATION

(July 2000 - June 2001)

A U.S. Department of Education Technology Innovation Challenge Grant

submitted to the Project by:
ROCKMAN *ET AL*
San Francisco, CA

Fall, 2001

Acknowledgements

We wish to acknowledge the contributions of the following individuals from the MetroLINC staffs in Boston and Watertown for their insights, assistance and support: Ann Grady, Alice Santiago, Lisa Breit, Jack Casey, Laura Junior, Lisa McNulty, and other members of the OIT and Watertown staff. Many thanks also to research colleagues, Anne Shure and Kay Sloan, for their valuable expertise and assistance in our evaluation efforts.

We also thank the many teachers in Boston and Watertown who shared their experiences and perspectives with us, by completing questionnaires, talking with us, and allowing us to visit their classrooms.

Cynthia Char
Candy Miller
Nancy Gadzuk
Saul Rockman

SOLIDIFYING THE GAINS:

METROLINC YEAR 4 EVALUATION

(July 2000 - June 2001)

A U.S. Department of Education Technology Innovation Challenge Grant

submitted to the Project by:
ROCKMAN *ET AL*
San Francisco, CA

Fall, 2001

ROCKMAN *ET AL* **605 Market Street, #305** **San Francisco CA 94105**
415/543-4144 www.rockman.com **Fax: 543-4145**

BACKGROUND AND INTRODUCTION **1**

SECTION I: YEAR 4 PROGRAM INITIATIVES: INITIAL AND CONTINUED INDUCTION OF TEACHERS IN TECHNOLOGY USE **4**

- **FINDINGS** 8
- **ACCESS TO TECHNOLOGY** 8
- **CLASSROOM TECHNOLOGY USE** 10
- **PROFESSIONAL GROWTH** 15
- **PERCEIVED VALUE** 19
- **LEADERSHIP DEVELOPMENT** 22
- **TEACHERS' EVALUATION OF DIFFERENT METROLINC ACTIVITIES AND SUPPORT** 25

SECTION II. SUSTAINABLE IMPACT OF METROLINC UPON TEACHERS' USE OF TECHNOLOGY AND LEADERSHIP ROLES IN TECHNOLOGY **30**

- **FINDINGS** 31
- **CONTINUED COMPUTER USE** 31
- **GREATER TECHNOLOGY ACCESS** 32
- **USE OF TECHNOLOGY RESOURCES** 34
- **CONTINUED USE OF PREVIOUSLY DEVELOPED MATERIALS** 35
- **BUILDING A COMMUNITY OF PRACTICE** 36
- **DISSEMINATION EFFORTS WITHIN METROLINC** 37
- **TECHNOLOGY LEADERSHIP** 38
- **PERCEIVED VALUE AND IMPACT OF THE METROLINC PROGRAM** 41

SECTION III: CONTINUING STUDIES ON MTEROLINC PARTNERSHIPS AND STUDENT ACADEMICACHIEVEMENT **43**

- **FINDINGS** 43
- **METROLINC PARTNERSHIPS STUDY** 43
- **IMPACT ON STUDENT ACHIEVEMENT: PAST AND CONTINUING EFFORTS** 48

SECTION IV: CONCLUSIONS AND RECOMMENDATIONS **50**

- **CONCLUSIONS** 50
- **RECOMMENDATIONS** 51

Solidifying the Gains

Background and Introduction

The MetroLINC Year 4 evaluation conducted this past year was comprehensive and comprised of two major studies. The first study focused on teachers involved in the wide range of Year 4 (June 2000–May 2001) program initiatives conducted by MetroLINC staff in Boston and Watertown, and concerned initial and continued induction of teachers in technology use. The second study is an investigation of the sustainable impact of MetroLINC on teachers who have participated in Years 1, 2, and 3 of the program.

The evaluation efforts addressed three major research questions:

1) To what extent have teachers used the resources and support provided through participation in MetroLINC to implement curriculum integrated with technology?

2) Has participation in MetroLINC resulted in changes in:
   - Classroom practices around technology
   - Teachers' professional growth and support
   - Teachers' leadership capabilities around technology

3) What has been the impact of MetroLINC on teachers' continued use of technology with students? Is the impact on teachers evident even a year or two after participation in MetroLINC?

Research design and methodology: Our research efforts encompassed a wide range of methods for gathering data, including face-to-face interviews with MetroLINC teachers and program staff, observations of key program events and meetings, and written surveys. Written surveys were administered to: all teachers in Boston and Watertown who are participating in MetroLINC this current year (Year 4 teacher survey; 2000-2001 school year); a core set of teachers in Boston and Watertown who had participated in MetroLINC in previous years (follow-up survey), and a comparison group of Watertown and Boston teachers who have not participated in MetroLINC (comparison group).

Survey samples and constructs: Year 4 teachers consisted of 66 teachers (47 Boston, 19 Watertown) participating in MetroLINC during Year 4, representing a total of 14 Boston schools and four Watertown schools. For the "follow-up" study, the sample consisted of 42 teachers (25 Boston and 17 Watertown) who have participated in MetroLINC in previous years. These teachers were drawn from four core Boston elementary schools identified by the Boston MetroLINC project director as having the greatest number of MetroLINC teacher participants, and from all four Watertown schools that have participated in MetroLINC. The comparison group sample consisted of 39 teachers (28 Boston and 11 Watertown) who have not participated in MetroLINC, drawn from the four

core Boston schools and four Watertown schools that constituted the schools in the "follow-up" study.

We designed surveys to measure seven different constructs that addressed our research questions:

- Use of varied technology-related resources
- Frequency of use of technology resources
- Expertise using technology
- Professional growth and support
- Beliefs and capabilities about curriculum planning and implementation
- Leadership capabilities regarding technology
- Extent of use of MetroLINC resources and support

On-going Studies: Two additional studies were also initiated during Year 4, which will extend into Year 5. These studies are an examination of the various partnerships that have been pursued by MetroLINC directors and several non-profit organizations and higher education institutions in Boston, and a pilot study on the possible effects of MetroLINC teacher participation on subsequent student achievement. Findings from these two studies will be available in our Year 5 report.

Background: Year 4 MetroLINC program efforts: In contrast to Years 2 and 3 of MetroLINC, the program initiatives adopted by Boston and Watertown were more divergent in appearance and strategy this past year, while still addressing some common priorities.

In Boston, the major Year 4 activity was the provision of ten team grants to engage groups of teachers (most often from within a single school) to develop a specific, computer-related curriculum model over the course of the school year and materials that could be used by other teachers in the district. This approach is in contrast to the Pioneer-Adapter model in place in Years 2 and 3, during which MetroLINC teachers were expected to actively develop and implement a curriculum unit in their classroom during the year. The Year 4 team members were considered relative "equals" from a single school and departed from the Pioneer-Adapter model of mentor and mentees teams spanning various schools used in Years 2 and 3. The team grants were designed to address the continued learning curve of the district's "higher-end" technology adopters, who were fairly technologically savvy but lacked opportunities to continue their learning and to be connected to a technology-oriented collegial network within the district. Facilitators who were Pioneers in previous years of MetroLINC headed five of the ten team grants. Grants involved teachers from kindergarten through high school, and the majority of these grants focused either on literacy, science, or enabling students to be independent users of technology.

In Watertown, the major focus of Year 4 involved a continuation of the Pioneer model from Years 2 and 3, in which teachers were asked to design and implement a curriculum-based unit that used technology to support the standards. Nine different individual grants

were awarded, in which teachers could work either individually or in pairs, as in Year 3. In addition there were three team grants, in which three to four teachers within a school worked together to develop and implement a curriculum unit or set of activities. Grants involved teachers from preschool through eighth grade, and spanned a diverse range of subject areas (e.g., literacy, science, mathematics, and foreign language).

Organization of report: Section I of this report presents our findings on the teachers participating in MetroLINC in Year 4. Section II presents findings on the teachers who have participated in prior years of the program (Years 1, 2 and/or 3). Section III presents a discussion of several on-going research efforts that we began in Year 4, which will extend into Year 5, the final year of MetroLINC. These on-going research efforts include an initial examination of the various partnerships that have been pursued by MetroLINC directors and several non-profit organizations and higher education institutions in Boston, and a pilot study on the possible effects of MetroLINC teacher participation on subsequent student achievement.

SECTION I: Year 4 Program Initiatives: Initial and Continued Induction of Teachers in Technology Use

Year 4 MetroLINC program efforts: In contrast to Years 2 and 3 of MetroLINC, the program initiatives adopted by Boston and Watertown were more divergent in appearance and strategy this past year, while still addressing some common priorities.

In Boston, the major Year 4 activity was the provision of ten team grants to engage groups of teachers (most often from within a single school) to develop a specific, computer-related curriculum model over the course of the school year that could be used by other teachers in the district in future years. This approach is in contrast to the Pioneer-Adapter model implemented over the previous years, during which MetroLINC teachers were expected to actively develop and implement a curriculum unit in their classroom during the year. For Year 4, the teacher teams designed and produced a "deliverable," a set of materials to support student use of technology for standards-based instruction.

Each team consisted of four or five teachers, led by a facilitator, and was expected to meet at least monthly in order to develop these units in a timely fashion. The teams were of relative "equals" from a single school and departed from the Pioneer-Adapter model of mentor and mentees teams spanning various schools used in Years 2 and 3. The rationale, according to Boston MetroLINC director Santiago, was to offer something to the district, which addressed both the time constraints of team members working across school buildings (a common concern voiced in the Year 2 and 3 evaluations), and to optimize the building of school capacity (a finding reported in the case studies of the Year 3 evaluation report). The team grants were also designed to address the continued learning curve of the district's "higher-end" technology adopters, who were fairly technologically savvy but lacked opportunities to continue their learning and to be connected to a technology-oriented collegial network within the district. Facilitators who were Pioneers in previous years of MetroLINC headed five of the ten team grants.

Team grants addressed the full spectrum of K-12 grades, but primarily focused on literacy/language arts and science, prominent district goals for this school year. Teams worked together over the course of the 2000-01 school year, and submitted a final product of work to the MetroLINC director in the late spring. These team products are being made available as a CD in late summer 2001 to interested educators in the district.

In Watertown, the major focus of Year 4 involved a continuation of the Pioneer model from Years 2 and 3, in which teachers were asked to design and implement a curriculum-based unit that used technology to support the standards. Nine different individual grants were awarded, in which teachers could work either individually or in pairs, as in Year 3. In addition there were three team grants, in which three to four teachers within a school worked together to develop and implement a curriculum unit or set of activities. Grants involved teachers from preschool through eighth grade, and spanned a diverse range of subject areas (e.g., literacy, science, mathematics, foreign language).

The variety of subject areas addressed across the two districts is shown in Table 1. The table also reveals the comparable focus of both districts on their elementary schools (six of the ten Boston team grants and four of the twelve Watertown grants), while exercising different district strategies for the upper grades (targeting the middle school in Watertown, versus reaching out to involve three high schools in addition to one middle school in Boston.) (Note: the MetroLINC grant initially focused on elementary and middle schools.) Of the 22 Year 4 grants across the two districts, three grants specifically targeted special education students.

Table 1: Year 4 MetroLINC Projects, by Subject Area

School Level & District	Science/Math	Literacy/Language Arts	Technology	Other
Elementary (Boston)	• Elementary Science Exemplars (cross-school team)	• Helping Students Reach Higher Levels (Curley) • Interactive Literacy Experience (Trotter)	• Student Technology Training (Shaw) • The Technology Helper (Holmes)	Multimedia Access to Curriculum Standards for Students with Special Needs * (O'Hearn)
Elementary (Watertown)	--	• Early Literacy Learning and Assessment with Technology (Hosmer) • Using Multimedia to help Learning-Disabled Students Learn Literacy * (Hosmer)	• Technology Infusion Experiment (Hosmer)	• Historic Watertown (Social studies; Cunniff & Hosmer)
Middle School (Boston)	--	--	--	Boston 2000 (Social studies; Gavin)
Middle School (Watertown)	• Field Guides Around the World • Washington DC Math & Science Trail	• Using Multimedia to Learn Language Arts and Social Studies	• Programming and Simulation Learning for Middle School Students	• Theme Board Game (Occupat'l Ed. & World Languages) • Integrating Palmtop Technology into Physical Ed. & Health • Piloting Our Route through Classroom Records • 7th & 8th Grade Homework Web Pages*
High School (Boston)	• Boston Latin School Science Web Page Development • Using Technology in the Science Fair Process (Fenway)	• Enhancing Literacy through the Arts (Boston Arts Academy)	--	--
High School (Watertown)	--	--	--	--

*Specifically targets Special Education students

Research methods: The evaluation team used a variety of data collection methods, including observations, interviews, and written surveys. Members of the evaluation team observed major events of the Boston and Watertown team and individual grants, including the Summer 2000 teacher institute, two of the winter call-back sessions for Boston teams, fall and spring meetings of Watertown teachers, and the culminating spring showcase events in both Boston and Watertown (each district held their own showcase), in which teams presented their work to the larger school community. We conducted team interviews with three different Boston teams selected to represent the diverse range of subject areas addressed by the development teams, including student assessment in language arts, student assessment in science, and special education resources for teachers. We also conducted individual interviews with six Watertown teachers (representing two of the three team grants, and three of the individual grants) to learn about the units being implemented in classrooms during Year 4 and to see examples of student work.

Across both districts, the evaluation team administered pre and post-program surveys to all participating Year 4 teachers, to examine current classroom practices and professional development concerning technology use, and possible changes that occurred over the past school year. The pre-program survey was administered to teachers at the Summer 2000 institute (June 2000), while the post-program survey was administered to Boston teachers in-person at their March callback session and to Watertown teachers by mail in April 2001. Comparison groups were approached utilizing methods suggested by the MetroLINC directors in their district. Comparison group surveys were handed out to teachers who taught at the four core schools in Boston, and were administered by mail to teachers in Watertown.

Survey sample for Year 4 teachers: As noted in Table 2, below, we received 77 completed pre-program surveys and 70 post-program surveys. In order to examine changes occurring over the course of the year, data analysis was conducted on the surveys submitted by the 66 teachers (47 Boston, 19 Watertown) who had completed both pre- and post-program surveys. These 66 teachers represented all ten of the Boston team grants, and all twelve Watertown team and individual grants. Collectively, the 66 teachers were drawn from 14 different Boston schools and four different Watertown schools.

Table 2: Teacher Sample for Year 4 and Comparison Group Teachers

	Teachers contacted	Completed surveys	Return rate
Year 4 Pre-survey - Boston	56	51	92%
Year 4 Pre-survey - Watertown	26	26	100%
Year 4 Post-survey - Boston	56	50	82%
Year 4 Post-survey - Watertown	26	20	77%
Comparison group survey - Boston	42	28	66%
Comparison group survey - Watertown	30	11	37%

As noted earlier, the Boston MetroLINC director adopted a new strategy in Year 4 of offering team grants to the "high-end users" in the district, while the Watertown ML director continued to utilize the Pioneer-Adapter model from previous years, designed to induce growing numbers of teachers in the district to use technology in their classrooms. These differing district strategies are reflected by our survey sample of Year 4 teachers. Of the 47 Boston teachers in our sample, 15 teachers (32%) had participated in previous years of MetroLINC, either as a Pioneer and/or Adapter. In contrast, only one of the 19 Watertown teachers in the survey sample had previously been a MetroLINC teacher.

For the comparison group, we distributed a total of 72 surveys (42 Boston and 30 Watertown), with financial incentives offered to those who returned completed surveys. Multiple calls and reminders were issued to teachers who did not return surveys by the requested deadline. Overall, 39 teachers returned their completed surveys (28 Boston and 11 Watertown).

Other evaluation efforts concerning Year 4 activities: In addition to observing the efforts and activities of the Boston team grants and Watertown team and individual grants, the evaluation team also observed sessions of several other MetroLINC efforts initiated in the two districts this past year. To sustain technology efforts in the district, Watertown offered a professional development program for various district-level curriculum leaders through its FITS (Full Infusion Technology) Project. The evaluation team observed the initial fall session of this FITS Project, and remained in conversation with Watertown MetroLINC project director Breit about these activities over the course of this past year. In Boston, the evaluation team observed the second session of the Encarta African Teacher Inquiry Group in March, organized in conjunction with partner institution, Wheelock College. The evaluation team plans to continue to monitor the progress and impact of both of these projects in Year 5, if warranted by sufficient program activity, and district priority.

Findings

As in the past, we want to portray the access of technology in the districts, and teachers' uses of technology in their classrooms, highlighting some of the common issues across the two districts. Following that, we will present some of the findings concerning teachers' professional growth and support resulting from MetroLINC, and the extent to which it has contributed to teachers' leadership capabilities around technology. We then discuss the ways in which teachers used various MetroLINC events and support, and the extent to which teachers viewed them as valuable.

Access to Technology

What kind of technology access do Year 4 MetroLINC teachers have? Is their hardware access different from other teachers in their district?

Summary: We found that Year 4 MetroLINC teachers have greater access to computers in their classrooms when compared to other teachers in their district, as well as greater access to the Internet in their classrooms. At the same time, the number of classroom computers varied considerably across Year 4 MetroLINC teachers, with some having as few as one or none, while others had five or more. The variation of computer access among Boston teachers seems to reflect different histories of participation in MetroLINC. Teachers having fewer computer resources were new to MetroLINC this year, and did not benefit from receiving up to four new computers, which had been possible for Boston Pioneers and Adapters who participated in MetroLINC in previous years.

Access to a computer lab was available to the vast majority teachers in the two districts, whether or not they were MetroLINC teachers. Access to a home computer was also widespread amongst MetroLINC teachers, with all of the teachers across both districts reporting that they have home computers this year.

Number of computers in the classroom: MetroLINC Year 4 teachers have greater classroom access to computers than other teachers in their districts. Some of this access is a result of the accumulation of technology that accompanied participation in the first several years of the MetroLINC program. When comparing MetroLINC Year 4 teachers to comparison group teachers, regression analysis showed that Current Year 4 teachers had, on average, at least one more computer in their classrooms than the comparison group teachers (means of 3.4 versus 2.0). This difference was found to be statistically significant *($t = 2.37$, $p < .05$)*.

Somewhat surprisingly, however, many Year 4 teachers—both in Boston as well as Watertown—had a relatively modest number of computers for use in their classrooms. As shown in Table 3, below, about one-third of Year 4 teachers (33%) had one or no computer in their classroom, about one-third (34%) had between two or three computers, and the remaining one-third (32.5%) had four or more computers. Current figures for numbers of students per computer in the US is now about 5-to-1, which would suggest about four to five computers for a classroom or fewer for schools with labs available for students to use.

Table 3: Number of computers in classroom

	0	1	2	3	4	5	6	7 or more
Boston	6 (12.5%)	8 (17%)	6 (12.5%)	8 (17%)	7 (15%)	3 (6%)	1 (2%)	9* (19%)
Watertown	0	8 (42%)	7 (37%)	2 (11%)	0	1 (5%)	0	1* (5%)
Total	6 (9%)	16 (24%)	13 (19%)	10 (15%)	7 (10%)	4 (6%)	1 (1.5%)	10 (15%)

*4 of 9 of the Boston teachers and the 1 Watertown teacher reporting 7 or more computers were the computer specialists in their school

All but one of the 14 Boston teachers who had none or only one computer were new to MetroLINC this year. Thus, they have not benefited from the largesse of past years. While each team in Boston had a budget of up to $10,000 to spend amongst its members for software, materials and stipends, they were not able to use the funds to purchase new computers for teachers. The teachers were generally members of team grants that focused on MetroLINC projects that did not require students to often use classroom technology, such as development of the school's web page for use in the sciences, students' use of the Web to develop science fair projects, or enhancing students' technology skills to enable them to work more independently in the computer lab.

While most Watertown teachers had only one or two computers in their classroom, Year 4 Watertown teachers reported a marked increase in the number of computers they had in their classrooms this past year. Prior to Year 4, most Watertown Year 4 MetroLINC teachers (83%) reported having only one computer in their classroom. At the end of Year 4, this number was reduced by half, and 42% of the teachers reported having only one computer, and 58% of the teachers having two or more computers in their classroom (21% have three or more computers in their classroom). Interestingly, three of the eight teachers who reported use of only one computer in their classroom were ones who in fact were members of one of the two team grants featuring AlphaSmart keyboard. Thus their reporting of having only one computer somewhat underestimates students' actual access to computers this past year, since the AlphaSmarts dramatically increased students' daily access to computers in the classroom. There were no changes in numbers of computers in the classroom reported by Boston Year 4 teachers.

Internet access in the classroom: MetroLINC teachers, in addition to having more computers than other teachers in their districts, also had greater access to the Internet in their classrooms. Regression analysis showed that current Year 4 teachers had, on average, at least one more computer in their classroom connected to the Internet this year than comparison group teachers (means of 2.71 versus 1.15). This difference was found to be statistically significant *($t=2.71$, $p<.01$)*.

Teachers' access to the Internet in their classrooms was generally higher in Watertown than in Boston. All of this year's ML teachers in Watertown have one or more computers in their classroom connected to the Internet, compared to about two-thirds of Boston's MetroLINC teachers; that leaves one-third of Boston's most technology-active teachers without classroom access to the Internet. Approximately one-half of the participating ML

teachers in both Boston and Watertown reported that they have two or more computers in their classroom connected to the Internet.

When comparing ML teachers to comparison group teachers, a dramatic difference was found amongst Watertown teachers. While one-half of Watertown's ML teachers reported having two or more classroom computers connected to the Internet, only 9% of comparison group teachers in Watertown were that well connected.

Access to a computer lab: In Watertown, both Year 4 teachers and comparison group teachers reported an increase in access to the computer lab, increasing from 91% of teachers last year to 100% this year. Computer lab access for ML Boston teachers decreased from 90% last year to 78% this year; this decrease is consistent with the Boston approach to minimize computer lab use and encourage classroom access and use. Comparison group teachers in Boston reported an increase in computer lab access from 67% last year to 89% this year.

Computer upgrades, special hardware and software: Almost all of the Watertown MetroLINC teachers (95%) reported that they had received computer upgrades, special hardware or new software this year as a result of MetroLINC, compared to a little over one-third (39%) of MetroLINC Boston teachers. These differences seem to reflect the different "incentive/compensation" arrangements employed by the two districts during Year 4. In Watertown, MetroLINC teachers were encouraged to propose and implement technology projects that allowed them to experiment with different ways to use technology in curricula, and included provisions for teachers to submit a "technology wish list" of the kinds of computer peripherals (scanners, digital cameras, etc.) deemed necessary to implement their projects. In Boston, teams were able to submit a budget of how they would choose to spend the $10,000 allocated to each team grant, which could cover costs regarding stipends, software and hardware peripherals.

Access to a home computer: All of the teachers in both Boston and Watertown reported that they have home computers this year.

Classroom Technology Use
In what ways are Year 4 MetroLINC teachers using technology in their classrooms? Does their technology use look different from other teachers in their districts?

Summary: Year 4 MetroLINC teachers increased the amount of time their students used technology for standards-based curriculum at higher levels than other teachers in their districts. The majority of MetroLINC teachers reported using technology in the area of language arts, reflecting the high priority in both districts upon improving students' literacy. Accordingly, word processing software was the most commonly used software tool. Most teachers also reported using content websites on the Internet, instructional software and CD-ROMs, and software tools such as presentation software, spreadsheets and graphing software, graphic organizers and graphics software. Frequency of use of these technology resources, however, was fairly moderate, with about one-half of the

teachers reporting that they used each of these kinds of software applications about one to two times a month, or less. About one-third of the teachers in each district reported that students' use of the computer lab involved activities that the teachers had co-designed with the computer specialist, rather than primarily relying on the lab to provide students with activities that the computer specialist designed alone, which is more typical of most schools. Watertown teachers, in particular, reported heavy use of the computer lab for activities that they themselves had designed independently, presumably due to the more limited computer resources they had in their own classrooms, which precluded more large group work on the computers.

Technology use for standards-based curriculum activities: MetroLINC teachers have increased their use of technology for classroom curriculum work more than other teachers in their schools. Teachers were asked to "rate the amount of time their students use technology for standards-based curriculum activities as compared to last year", using a five point scale in which 0 indicated "decreased a lot", to 4 indicating "Increased a lot". While both the MetroLINC and the comparison teachers did increase their use of technology, the comparison group mean of 2.43 (n = 39) was found to be significantly lower than the mean of 3.1 (n = 70) for MetroLINC teachers *($t = 4.09$, $p < .001$)*.

Subject area focus of technology use: Participating teachers used computers for a variety of standards-based activities. While the original MetroLINC proposal had targeted the areas of science and mathematics, most teachers applied technology in the area of language arts. This appears to reflect the high priority placed upon literacy in the two districts. As shown in Table 4, the primary focus on language arts (69%) was followed by science (41.5%), mathematics (34%) and social studies (28%). Watertown teachers reported a higher use of software related to mathematics and social studies, as compared to their Boston counterparts.

Table 4: Primary Subject Areas Addressed by Students' Software and/or Internet Use

	Language Arts	Science	Mathematics	Social Studies
Boston (n = 46)	65% (30)	41% (19)	28% (13)	22% (10)
Watertown (n = 19)	79% (15)	42% (8)	47% (9)	42% (8)
Both Districts (n = 65)	69% (45)	41.5% (27)	34% (22)	28% (18)

Use of varied technology related resources: When compared to other teachers in their schools, MetroLINC teachers reported using higher levels of a variety of technology-related resources with their students overall. Regression results show that the current year 4 teachers reported significantly more frequent use of varied technology related resources than comparison group teachers *($t = 3.33$, $p < .01$)*.

Specifically, word processing software was used most commonly with students, used by 87% of teachers. About one-half (56%) of the teachers reported using word processing at least a few times a week, and 25% reported daily use.

About three-quarters of the teachers reported using presentation software (75%) and spreadsheet and graphing software (73%), while about two-thirds used graphic organizers such as Inspiration (66%) or graphics software (63%). These four kinds of software were usually used by teachers only one to two times a month or less, although about a fifth of Boston teachers (18%) reported daily use of graphics software with their students.

Most Year 4 teachers in both districts (83% of all teachers; 78% in Boston and 95% in Watertown) report using content websites on the Internet with students. A relatively high proportion of teachers (44% of Boston and 68% of Watertown) report using the Internet at moderate levels of one to two times a month or less. Despite easy Internet access to all Watertown classrooms, use was rather selective, with only 16% of teachers reporting daily use (compared with 6% of Boston teachers), and an additional 21% reporting using the Internet once or twice a week (compared with 28% of Boston teachers).

Most teachers, in both districts (92% in Boston, 95% in Watertown), use instructional computer software and CD-ROMs. About one-half of Boston teachers (45%) and Watertown teachers (53%) reported using such materials only one to two times a month or less. Higher proportions of Watertown teachers reported using such software daily (26% of Watertown vs. 14% of Boston).

Teachers' utilization of the computer lab: In Years 2 and 3, some of the MetroLINC Pioneers who were interviewed were their schools' computer specialists. They expressed that part of the value of MetroLINC was that it enabled them to work more closely with the classroom teachers in their schools to coordinate work done in the lab more closely with curriculum units being conducted by the classroom teachers. This contrasted with the more typical arrangement in which specialists see students every one to two weeks and have them work on activities that strengthened students' skills and familiarity with technology (e.g., how to use the Internet to do research, or how to use graphing software), but nonetheless in ways fairly unconnected with students' regular classroom work.

Thus, one of the areas we wished to examine were the ways in which MetroLINC teachers utilized the computer lab for their students. As indicated earlier, Watertown teachers tended to have students utilize the computer lab more regularly than Boston teachers, due to their more limited computer resources in their classrooms. As shown in Table 5, below, the majority of Watertown Year 4 teachers (67%) reported that they had students working in the lab on activities that the classroom teacher had designed, while about one-third indicated that they designed student activities in conjunction with the computer specialist. Furthermore, a higher percentage of Watertown teachers reported that they design the student activities this year as compared with last year, with an increase from 52% (pre-program) to 67% (post-program).

A somewhat different profile emerged for Boston Year 4 teachers, who reported that students usually either worked on activities planned independently by the computer specialist, or on activities designed solely by the classroom teacher. It was relatively less common for students to work on activities in the lab co-designed by the classroom teacher and computer specialist. No pre- to post-program changes were observed for Boston

teachers. This may be due in part to Boston teachers' emphasis on developing curriculum and assessment materials for broader district use during Year 4, rather then direct implementation in their own classrooms and schools.

Table 5: Teachers' characterization of students' typical use of the computer lab

	Work on activities that I designed	Work on activities that the computer specialist and I designed together	Work on activities that the specialist planned independently from me
Boston	41%	30%	46%
Watertown	67%	39%	39%

Year 4 Watertown Teachers – Classroom Impact: Unlike Boston Year 4 teachers who primarily focused on developing materials to be distributed more widely within their district, Year 4 Watertown teachers engaged in Pioneer projects similar to Years 2 and 3, in which teachers actively implemented a curriculum unit that utilized technology as a key component of the curriculum.

The 18 Watertown teachers who completed the survey collectively indicated a total of 832 students in Watertown who used their MetroLINC units. (The actual number is somewhat lower, given that a number of the middle school teachers work with similar sets of students in their respective subject areas.) The number of students with whom each MetroLINC teacher worked varied considerably, with about one-half of the teachers (7) teaching a typical sized single classroom of 15-20 students, while about one-half (8), all from the middle school, taught multiple classrooms of students, numbering a total of anywhere between 40 and 140.

Table 6: Number of students using MetroLINC units, by teacher

Less than 5 students	15-20 students	25-32 students	40-60 students	100-140 students
1 teacher	7 teachers	2 teachers	4 teachers	4 teachers

In terms of frequency and duration of use, MetroLINC Watertown teachers chose to implement MetroLINC units that were quite considerable in length, with regular student engagement each week. Almost one-half of the Watertown teachers (45%) implemented their MetroLINC unit across the whole school year, while an additional 20% implemented a unit that was four to six months in length. Frequency of use was quite regular throughout the unit, with 75% of the teachers reporting that they used the unit at least weekly (of which 35% reported daily use).

The nine individual grants were quite diverse in focus, encompassing grants focusing on science and mathematics (3 grants), writing and literacy (2), foreign language (1), and physical education (1). Two projects focused specifically on the needs of special needs students, one which used Intellitools with elementary students with limited language skills,

and one that involved a homework web page to offer homework assistance to middle school students with special needs.

Perhaps given this diversity of curriculum foci, teachers indicated a variety of areas of knowledge and skills that they feel their students had gained through their MetroLINC classroom experience. Half of the teachers indicated that they felt their students had acquired a significant amount of additional knowledge and skills regarding subject area knowledge, technology skills, collaboration skills, and self-esteem. Over one-third of the teachers reported significant increases in writing skills and inquiry and research skills. These areas of greatest student growth were almost identical to those identified by both Watertown and Boston teachers in Year 3.

Table 7: Areas in which teachers report that their students acquired knowledge and skills

Instructional Outcome	% of teachers indicating "a lot" of improvement over the past year
Technology skills	50%
Subject area knowledge	50%
Collaboration skills	50%
Self-esteem	50%
Writing skills	40%
Inquiry and research skills	35%
Project-based learning	30%
Cross-disciplinary work	20%
Presentation skills	15%

As illustration of MetroLINC units promoting technology skills, writing skills, collaboration and self-esteem, all three Watertown team grants involved students regularly using word processing to produce writing assignments. Two of these team grants utilized a set of AlphaSmarts in their classroom, thereby dramatically increasing the amount of daily writing students were able to do with the computer. A number of the teachers described the ways in which they felt the students' writing skills had improved, and that they were writing a lot more. Two classrooms worked together to produce several editions of a student newspaper, as well as a class album. As in past years, some of what is described as benefits of using the computer are its motivational aspects—that students are more excited about writing with the computer, and experience pride in having work "published" or posted on a website. As one of the teachers expressed, "My students are producing better written work, as everyone wants at least one article in the newspaper, "The Samarian and Bender Times".

Professional Growth

What kinds of professional growth have been afforded through MetroLINC? Has this been primarily in enhanced technology skills, or has it extended to other areas of knowledge and classroom practice?

Summary: MetroLINC provided teachers with opportunities to strengthen their knowledge and application of technology in the curriculum. Year 4 MetroLINC teachers reported significantly more professional growth than comparison group teachers in three technology areas: enhanced knowledge of technology, more effective use of technology with students, and greater integration of technology in curriculum. Year 4 teachers also reported significantly more professional growth regarding increased networking with colleagues, reflecting the team-oriented grants and projects across both districts. Year 4 teachers, however, did not report significant growth in other aspects of pedagogical approaches, curriculum planning, and assessment, in contrast to comparison group teachers. It appears as though teachers regard the professional development offered by MetroLINC as fairly concentrated in the area of technology in the curriculum, as opposed to broader curriculum, assessment approaches and practices.

Areas of professional growth: technology versus broader educational foci: The emphasis of MetroLINC in providing teachers with opportunities to strengthen their knowledge and application of technology in their curriculum was evidenced by Year 4 MetroLINC teachers reporting significantly more professional growth than comparison group teachers in three technology areas:

- *Enhanced knowledge of technology*, with a mean of 2.3 versus a mean of 1.9 for comparison group teachers *(t=3.29, p=. 001)*;
- *More effective use of technology with students*, with a mean of 2.5 versus a mean of 1.7 for comparison group teachers *(t=5.06, p<. 001)*;
- *Greater integration of technology in curriculum*, with a mean of 2.4 versus a mean of 1.6 for comparison group teachers *(t=5.87, p<. 001)*;

Year 4 teachers also reported significantly more professional growth regarding increased networking with colleagues, with a mean of 2.4 versus a mean of 1.9 for comparison group teachers *(t=3.04, p<01)*, reflecting the team-oriented grants and projects across both districts.

Year 4 teachers, however, did not report significant growth in other aspects of pedagogical approaches, curriculum planning, and assessment. In contrast, comparison group teachers reported that they experienced significantly greater professional growth over the past year in three non-technology areas of professional growth:

- *Broader knowledge of content*, with a mean of 2.3 versus a mean of 1.8 for MetroLINC teachers *(t=2.68, p< .01)*;
- *More student-centered classroom environment*, with a mean of 2.5 versus a mean of 2.0 for MetroLINC teachers *(t=3.08, p<. 01)*;

- *Increased understanding of student assessment*, with a mean of 2.3 versus a mean of 1.9 for MetroLINC teachers *(t = 2.66, p<. 01)*;

Three additional non-technology areas of professional growth—changes in the way I teach basic subjects, more project-based instruction, and enhanced skills in working as part of a team—showed no significant differences between Year 4 and comparison group teachers. It appears as though teachers regard the professional development offered by MetroLINC as fairly focused on the uses of technology in the curriculum, as opposed to broader curriculum, assessment approaches and practices.

Relationship between MetroLINC participation and curriculum planning and implementation. On a related note, one of the constructs measured by survey items concerned teachers' beliefs and practices about curriculum planning and implementation, including aspects of varied teaching strategies, assessment strategies, and the extent to which they held constructivist beliefs. Year 4 teachers do not appear significantly different in their orientation and practices in curriculum compared with other teachers in their schools. No significant differences were found between the comparison group and MetroLINC teachers on their end-of-year reports, with means of 15.28 and 15.32, respectively. Nor did Year 4 teachers experience any substantive changes related to curriculum beliefs and practices over the course of the year. An examination of pre- to post- change scores for Year 4 teachers showed no significant change in their beliefs and practices about curriculum planning and implementation, with a mean that actually decreased slightly from 15.32 (n=66) prior to this current year to 14.98 after this current year's participation in MetroLINC

Further analysis (using Pearson product-moment correlation analysis), however, revealed that there is a positive and moderate association between MetroLINC teachers' use of varied technology-related resources and their beliefs about curriculum planning and implementation *(r=. 47, p<. 0001)*. Analysis shows that 22 percent of the variation in the use of varied technology related resources is associated with variation in teachers' beliefs and practices about curriculum planning and implementation. This relationship remains the same even after considering other variables, such as district, years of teaching experience, education, and prior training.

Examination of these constructs also showed that teachers who scored higher on curriculum planning and implementation prior to their participation in MetroLINC during Year 4 were moderately more likely to use varied technology resources more frequently throughout the year *(r=. 40, p<. 001)* than teachers who scored lower on this dimension. Regression analysis showed that 15 percent of the variation in the use of varied technology related resources over the last year was associated with teachers' prior beliefs and practices about curriculum planning and implementation. This relationship remains the same even after considering other variables, such as district, years of teaching experience, education, and prior training.

Thus, teachers who were more likely to implement varied technology resources frequently throughout the year were those individuals more oriented towards curriculum practices that

utilized such constructivist approaches as group or individual projects, portfolio assessments, hands-on and student centered activities, and have students engaged in problem-solving strategies, research projects, class presentations, and self- and peer-editing. This seems logical in that a number of the technology applications use software tools (e.g., word processing, presentation software, graphic organizers, and spreadsheets), which lend themselves to students' writing and expression of ideas, or mathematical problem solving, while other applications such as the use of content websites offer rich resources of information for student research projects.

What is less clear is whether a technology-oriented project such as MetroLINC could have also fostered teachers' deeper understanding of various curriculum reform and assessment that are important initiatives in each of the districts. By design, the Year 4 teachers in Boston were able to propose a project of personal interest, whether it be, for example, towards developing materials to enhance student assessment in science that is more oriented towards open-ended responses on the MCAS, or towards enabling students to become more familiar with various software tools in order for them to be more self sufficient to do writing and research projects in the computer lab. Furthermore, the Boston teachers represented the full K-12 span of students. Watertown teachers also were able to propose particular individual and team grants of interest across different subject areas, and subsumed both elementary and middle school grades. Thus, there was quite considerable variation in what the Year 4 teachers were engaged in this year regarding particular subject areas, concepts, and learning objectives for their students.

It does appear, however, that some teachers felt they could benefit from professional development sessions that more firmly grounded technological applications within certain curriculum approaches. For example, when asked in the post-program surveys what ways, if any, MetroLINC served as a catalyst for teachers' professional development, few individuals responded by discussing specific MetroLINC events or workshops. One of the few responses that mentioned a particular MetroLINC event pertained to the TERC workshop that focused on the use of technology for the mathematics curriculum, which has been adopted by the Boston Public Schools. This teacher expressed, "The full day workshop with TERC was extremely valuable. More advanced professional development of this nature is highly desired." Another MetroLINC teacher who has been involved in MetroLINC for three years also specifically mentioned the TERC workshop as very valuable in conveying what can truly be meant by technology integration into the curriculum, and how it can be done through fairly straightforward student activities and investigations. She felt that for many teachers, technology integration could mainly mean using technology that relates to one's curriculum, such as a teacher who is using "Millie's Math House" software would consider herself as doing technology integration, since the skills featured on the disk related to skills in her math curriculum.

Thus, there may have been opportunities offered by MetroLINC that would have been valuable for MetroLINC teachers and which could have more closely tied the use of technology into particular district initiatives, such as both districts' high priority on literacy, and Watertown's adoption of the Communities for Learning model, out of Temple University.

Expertise using technology: This construct looked at teachers' self assessment of their expertise using a range of different types of software applications typically used in their MetroLINC projects, such as word processing, presentation software, spreadsheet and graphing software, web page design, graphics, and use of the Internet. Items that were only included in the Year 4 pre- measured this construct and post- surveys and the end of the year comparison group survey. Pre to post change score differences for current year 4 teachers and differences between groups on reports of curriculum practices over the last year were analyzed.

As might be expected, Year 4 MetroLINC teachers reported that they felt more comfortable using technology with students and rated themselves higher in expertise using computers and other technology than other teachers in their school. This difference was found to be statistically significant *(t=2.69, p<. 01)*. Current year 4 MetroLINC teachers started off the year at a significantly higher level of comfort *(t=4.50, p<. 001)* with a mean of 5.40 compared to a mean of 4.06 for comparison group teachers.

An examination of pre- to post- change scores for current Year 4 MetroLINC teachers showed no significant change in how comfortable they feel using technology in the classroom with students, or to what extent they consider themselves an expert in using computers and other technology, with a mean of 5.4 prior to this current year and 5.43 at the end of this current year. Analysis of differences between groups showed no statistically significant changes on pre to post change scores.

The absence of an "across the board" change in expertise in this survey construct does not suggest, however, that teachers did not acquire much technical expertise through MetroLINC. When asked "what three things did you learn through MetroLINC this year?", teachers responded with highly individual or team-specific responses, citing specific pieces of software they learned or became more comfortable with, such as HyperStudio, web page software such as Front Page, Inspiration, and PowerPoint, or AlphaSmarts or how to use specific hardware peripherals such as a digital camera or large screen monitor.

Furthermore, some of the technical expertise that teachers expressed that they gained from participation concerned broader insights about using technology than simply competence with software applications:

> *It has helped me with thinking specifically, concretely about technology, and to extend the purposes of technology, and see technology as a means to an end in the process.*
>
> *It has made me reflect on how I might use technology more effectively and when I might choose not to use technology.*
>
> *It has given me permission to be more inventive with the use of technology in the class.*

I have learned a lot on how to use technology more effectively in the classroom. I have also learned that simple is better for the kids and for managing the class using technology.

Having the equipment has allowed me to think of new creative and useful ways to teach my students.

Perceived Value
What do Year 4 teachers see as the value and benefits of the MetroLINC program?

Teachers' perceptions of the value of MetroLINC program: Three-quarters of the teachers in both Boston and Watertown rated this year's work in MetroLINC teams as valuable to extremely valuable. Similarly, 94% of Boston teachers and 80% of Watertown teachers either agreed or strongly agreed that MetroLINC had been a useful catalyst in their development as a technology-using teacher.

When asked how the MetroLINC program was valuable, or in what ways it has been a useful catalyst, one common theme expressed concerned the team structure and the ways in which MetroLINC enabled them to collaborate with colleagues.

I get to collaborate with teachers outside my discipline – people I rarely get to work with.

Chance to work more closely with a colleague than is generally possible.

It has given us the time and exposure to other teachers developing similar projects.

Working with teachers around the city was incredibly valuable. Working on one concentration was helpful as well.

MetroLINC teams have been valuable because they have allowed me opportunities to collaborate with other teachers in my building and in other schools to improve the use of technology to enhance learning and teaching.

[It has given me] new friends with lots of enthusiasm and motivation and ideas.

Most of the teachers (81% of all teachers, 84% of Boston, 75% of Watertown) reported that they were collaborating with other teachers in their school to promote the use of technology. A smaller, but notable proportion of teachers (40% of all teachers; 46% of Boston and 25% of Watertown) also reported that they collaborated with teachers from other schools around technology use.

The Boston team grants encouraged teams of teachers drawn often from a single school to work together. Even though it largely involved teams of teachers who were familiar with one another, the three teams we interviewed talked about working together in new ways, primarily with the emphasis on creating a group product.

> *Although we have worked together on in-service courses and on the Math Development Team, we have not produced any real products.*
>
> *We have worked with others through the science departments, but not to produce any products that are technology-related. We have worked together to develop science specifications and to choose materials for science in the elementary schools and some of us have written curriculum. It has been great working together. We can build on each other and share knowledge.*
>
> *We have worked together before, but this project has been much easier than others. Our work as a team has been very successful with a lot of teacher interest in our schools.*

Furthermore, the requirement of involving five teachers per team did result in some new teachers being brought into the projects, due to some turnover on the original team membership:

> *I was asked to join the project when another teacher left due to a job change. I just started teaching in December…MetroLINC has allowed me to really feel part of my school, work with a larger number of students, and made me think of how I wanted to use technology in my future classrooms.*

As in past years, a small group of teachers talked about how MetroLINC's structure and project-oriented focus offered them the opportunity to concentrate more intensively on technology and its application to their classrooms:

> *MetroLINC provided a goal/project to work towards. I would have used the technology but not as much as I did to complete the project.*
>
> *Encouraged me to finish and publish some of my projects.*
>
> *Any time a school team comes together to discuss technology/curriculum it pushes us to think more and has an impact in the classroom. MetroLINC is a vehicle for doing that.*
>
> *Taking on the project forced me to make the time learning to use technology when I really didn't have time to. I would probably not have done what I ended up doing if I didn't have the structure provided by the program. This "pushing of the envelope" is beneficial to both teachers and students*

because we now have access to and the ability to use technology that really improves teaching and learning.

MetroLINC has been invaluable in providing me with the tools I need to use technology effectively. In addition, it has encouraged me to set more goals for improving my practice.

A relatively small number of teachers, primarily involved in science projects, described the value of the MetroLINC project residing in its enabling teachers to think more deeply about particular approaches to students' learning or assessment in their subject matter discipline:

[MetroLINC allowed us to] think more deeply. It helped the team really THINK about our entire science team process.

This year's work on my MetroLINC team has allowed me to develop good science questions which are much richer and much more in depth.

I have been able to further my understanding of student assessment and their ability to grow through technology.

It gave me the opportunity to meet with fellow science teachers and explore how technology can enhance our jobs/assessment of students.

I've become more aware of ways to use technology to enhance and encourage student writing.

A few teachers went on to describe how their involvement had enabled them to exercise new initiatives to further their involvement with technology, ranging from writing grants, and considering taking advanced courses, to simply logging on from home regularly:

It has given me the desire to get more technology for my classroom. We just wrote a grant to receive alpha smarts for the entire 4th grade.

Because of my involvement with MetroLINC, I am seriously considering a master's degree in Technology and Education.

Everything I learned about computers is because of MetroLINC. I had a computer at home but was ignoring it. My family thought I was being stubborn, but now I am taking my turn on the computer every night.

Leadership Development
Has MetroLINC increased teachers' leadership capabilities regarding technology? Has teachers' degree of involvement with MetroLINC had an impact on their technology use, their leadership capabilities, and professional growth?

Leadership capabilities regarding technology: One of the opportunities that MetroLINC provides, we have hypothesized, is the creation of a cadre of school building leaders who, through their increased skill with technology, are sought out for information and assistance. This year we have accumulated some indicators to support this belief. Teachers who participated in Year 4 reported that they provide assistance to other teachers more often, and have been involved in more activities that promote technology use and education within and beyond their school than comparison group teachers. The comparison group mean of 2.37 *(n = 39)* was found to be significantly lower than the mean of 5.50 *(n = 66)* for Year 4 teachers *(t=7.70, p<. 001)*. More than one-third of the variation in leadership capabilities regarding technology for current Year 4 teachers versus comparison group teachers is associated with whether or not teachers participated in MetroLINC; this is a substantial contribution and a strong relationship.

Further examination showed that significant differences exist between districts *(t=2.80, p<. 01)*, with Year 4 teachers in Boston reporting that they provide assistance to other teacher more often, and have been involved in more activities that promote technology use and education within and beyond their school, when compared to Watertown teachers. This district difference in leadership abilities appears to reflect the different program recruitment strategies adopted by the two districts. During Year 4 Boston targeted higher end technology users for work in school-based teams, while Watertown encouraged a wider range of teachers with less prior technology experience interested in exploring the potential of technology in their classrooms.

As indicated in Table 8, below, Year 4 teachers reported taking part in a wide variety of initiatives indicating growing leadership roles in the area of educational technology in their schools and in their districts. Most Boston teachers, a number of whom were multi-year MetroLINC teachers and/or had some prior technical expertise as they began Year 4, assisted other teachers with technology use in their schools. About one-half of the Boston teachers reported leading workshops and making presentations in their schools, serving on their school's Instructional Leadership team, writing technology grants, and attending technology conferences. Watertown Year 4 teachers, while relatively new to technology in general, still reported impressive numbers of teachers assisting other teachers with technology use in their schools and writing technology grants. A small cadre also reported leading workshops and making presentations in their schools, and attending conferences, and participating in on-line courses and listservs—quite notable achievements given their first year in MetroLINC.

Year 4 teachers also exercised additional initiatives to participate in workshops and courses other than those offered by MetroLINC. Most teachers (84%) indicated that they had participated in technology-related workshops in their school, and many (63%) had taken

courses in their schools as well. Teachers reported a somewhat higher frequency of taking advantage of professional development opportunities offered right in their schools, as opposed to events offered outside of their schools. About one-fourth of the teachers in both districts also reported participating in on-line courses or listservs.

Table 8: Leadership activities, by district

	Boston (n = 50)	Watertown (n = 20)	Total (n = 70)
Assisting other teachers w/ tech use in your school	40 (80%)	12 (60%)	52 (74%)
Assisting other teachers w/ tech use beyond your school	20 (40%)	3 (15%)	23 (33%)
Participating in workshops in your school	41 (82%)	28 (90%)	59 (84%)
Participating in workshops beyond your school	23 (46%)	7 (35%)	30 (43%)
Leading workshops in your school	24 (48%)	3 (15%)	27 (39%)
Leading workshops beyond your school	15 (30%)	2 (10%)	17 (24%)
Taking courses in your school	29 (58%)	15 (75%)	33 (63%)
Taking courses beyond your school	23 (46%)	12 (60%)	35 (50%)
Teaching courses in your school	18 (35%)	2 (10%)	20 (29%)
Teaching courses beyond your school	9 (18%)	1 (5%)	10 (14%)
Participating in on-line courses and listservs	14 (28%)	4 (20%)	18 (26%)
Making presentations in your school	26 (52%)	3 (15%)	29 (41%)
Attending conferences	27 (54%)	4 (20%)	31 (44%)
Making conference presentations	13 (26%)	1 (5%)	14 (20%)
Serving on school's Instructional Leadership Team (ILT)	24 (48%)	4 (20%)	28 (40%)
Writing Technology Grants	28 (56%)	8 (40%)	36 (51%)

The MetroLINC Boston team grants, which primarily drew upon teams for which members all taught in the same school, had the potential of having a broader impact within a school, rather than focused on a particular teacher's single classroom. A number of Boston teachers described the value of their MetroLINC projects in terms of this broader school context involving their colleagues, and their growing leadership and influence in the building:

> *As a team we were able to share a bunch of technological ideas and discuss how we can better help our colleagues implement our technology ideas into their daily curriculum.*

> *It has helped me motivate my staff to accept technology into their curriculum and created a more comfortable atmosphere to ask for tech help.*
>
> *I see many teachers becoming more involved in utilizing technology in their instruction; additionally, there is a corresponding change in instructional strategy.*
>
> *[Technology's] role has been more acceptable in the building – able to encourage other teachers' participation in coaching and implementing use of technology, encouraging more purchasing of technology, software and hardware. MetroLINC has really had an enormous impact on the building level.*
>
> *The idea of getting software, hardware and training in the hands of teachers who want it is fantastic. There's an interesting little cadre of Pioneers throughout the school that have raised the bar on technology use for everyone. Also, the ripple effects on student learning are great. One teacher teaches kids how to do HyperStudio, and we all benefit.*

One Boston team grant in particular, which involved developing teacher resources for special needs children, resulted in direct use by other teachers in this "full inclusion" school this past year:

> *Our principal has stated that he has observed some aspect of our product being implemented throughout every classroom in the school I think this is proof that what we are developing is useful and is being used widely by the teachers in our school*

Leadership development and degree of MetroLINC involvement: During Year 4, both Boston and Watertown MetroLINC staff offered a variety of resources and support to participating teachers including new software and special hardware, contact with MetroLINC staff and other MetroLINC teachers, and the MetroLINC Website. The extent to which MetroLINC teachers availed themselves of these resources and sources of support seemed to have a positive impact on the ways in which teachers used varied technology resources with their students, their leadership capabilities related to technology, their expertise with technology, and the professional growth and support that they experienced over the last year.

Correlation analysis showed the "extent to which teachers use the resources and support provided through MetroLINC" to be significantly positively and highly associated with the extent to which teachers used varied technology resources with their students *($r=.66$, $p<.001$)*. Regression analysis showed that almost half of the variation *($r^2=.43$)* in the extent of use of varied technology-related resources is associated with variation in the extent to which teachers used special hardware they were introduced to through MetroLINC, the

extent to which teachers had contact with other MetroLINC teachers, contact with MetroLINC staff for technical assistance, and the extent to which they used the MetroLINC web site to get ideas for integrating technology into their classrooms. A higher score on these dimensions is associated with more frequent use of varied technology related resources for Year 4 MetroLINC teachers.

Regression analysis also showed that the extent to which teachers used MetroLINC resources and support to be significantly related to:

- Their leadership capabilities related to technology use *(t=4.86, p<. 001)*, with 34 percent of the variation in leadership capabilities associated with variation in use of MetroLINC resources and support;
- Their expertise using technology *(t=4.35, p<. 001)*, with 29 percent of the variation in teachers' expertise associated with variation in use of MetroLINC resources and support; and
- The professional growth and support they experienced over the last year *(t=3.41, p<. 001)*, with 20 percent of the variation in professional growth associated with variation in the use of MetroLINC resources and support.

When examining other variables (district, gender, years of experience, prior training) in only one case were any of these variables found to be significant in addition to the predictor variable (extent to which teachers use MetroLINC resources and support). The relationship between teachers' leadership capabilities and their use of MetroLINC resources and support was found to vary significantly by district *(t=2.61, p<. 05)* with means for teachers in Watertown that were 1.51 points lower on average than teachers in the Boston school district. This probably reflects the differences in the prior technology expertise held by Year 4 teachers in Boston versus Watertown, due to Boston program's targeting of "higher end" technology users in general and inclusion of a number of MetroLINC teachers from past years, in contrast to Watertown.

Teachers' Evaluation of Different MetroLINC Activities and Support
How helpful did teachers regard the different Year 4 MetroLINC components, activities, and support?

Summary: As in Years 2 and 3, collaboration and support between MetroLINC teachers were seen as a key benefit of the MetroLINC program. Teachers' contact and communication with their teacher colleague who served as team facilitator, team leader, or project partner received very positive ratings, as did their contact with other MetroLINC team members. The Summer Institute was the meeting that was viewed as most helpful by teachers, more so by Boston than by Watertown. Most Boston teachers, whose Pioneer callback meetings were special training-oriented, full day "teacher release day" sessions, regarded the training sessions as very helpful. Watertown teachers, whose Pioneer meetings were held after school and more geared towards discussions of project information and team updates, tended to regard the sessions as generally helpful.

Collaboration and support between MetroLINC teachers: A prime element of the MetroLINC program since its inception has been the building of collegial relationships between technology-using teachers in each of the two districts. As in Years 2 and 3, collaboration and support between MetroLINC teachers were regarded as a prime element of the MetroLINC program. Teachers' contact and communication with their teacher colleague who served as team facilitator, team leader, or project partner received a very positive rating, with 77% of Boston teachers and 80% of Watertown teachers rating such contact as "very helpful." Contact with other ML team members was also viewed as similarly positive.

Assessment of MetroLINC events and staff support: Of the various MetroLINC events, meetings and types of support offered during Year 4, teachers viewed the Summer Institute most positively. As shown in Table 9, below, many MetroLINC teachers in both districts viewed the 2000 Summer Institute as quite helpful, with most of the Boston teachers and about one-half of the Watertown teachers rating it as "very helpful."

Boston teachers rated the two call-back sessions quite positively (full day professional day sessions for Boston teachers only made possible through MetroLINC funding for substitutes), with at least 88% of the teachers rating the events as "somewhat helpful" or "very helpful." As noted earlier, several teachers singled out the TERC session as being particularly helpful in giving them a better sense of technology integration in mathematics.

Figure 9: Teachers' Evaluation of Various MetroLINC Activities and Services (B = Boston; W = Watertown)

Activities & Services	Not at all Helpful	Slightly Helpful	Somewhat Helpful	Very Helpful
2000 Summer Institute	B- 2% W - 15%	B - 7% W - 15%	B - 24% W – 15%	B – 67% W – 54%
Session w/ TERC (Boston only)	B – 3%	B - 9%	B - 27%	B – 61%
Session on Training, Website development (Boston only)	B – 0%	B – 3%	B – 33%	B – 63%
Pioneers Kickoff Meeting April '00 (Watertown only)	W – 0%	W – 22%	W – 50%	W - 28%
Pioneers Progress October meeting (Watertown only)	W – 5%	W - 26%	W – 42%	W – 26%
Pioneers Progress March meeting (Watertown only)	W – 9%	W – 36%	W – 36%	W – 18%
Contact/communication with ML support staff	B – 0% W – 0%	B – 7% W – 17%	B – 30% W – 17%	B – 63% W – 67%
Contact/communication w/ your team facilitator (or team leader/partner)	B – 0% W – 0%	B – 2% W – 7%	B – 21% W – 13%	B – 77% W – 80%
Contact/communication w/ other ML team members	B – 0% W – 0%	B – 2% W – 0%	B – 23% W – 33%	B – 74% W – 67%
MetroLINC Web site	B – 13% W – 35%	B – 34% W – 41%	B – 34% W – 18%	B – 19% W – 6%

At the same time, a number of the Boston teams still expressed the difficulty in having time to meet as a team, despite largely working in the same school building, and wished that more time was devoted to working in groups:

> *More team time should be provided to work on projects rather than meeting with everyone.*
>
> *We really wanted more time to work on our project at school and it was hard for the team to get out all at one time. When we came here (OIT) we had to sit in on software presentations that were not appropriate or focused on what we needed and we already knew how to use everything. In addition, we had to sit in on these meetings but did not get any software [that was featured in the meetings.]*
>
> *The meetings have been hard during school time, but everything has been very useful. The team time at the beginning was most beneficial. It was more beneficial than the time for technology presentations. We actually needed more individual team time than time with the entire group of teachers.*

Several Boston teachers also expressed the need for a system where teachers can get PDP's for participation, and for the considerable time involved in developing their group product for the district.

Unlike the full day Boston sessions, the Watertown meetings were held after school and primarily devoted to disseminating information and raising teacher questions about the project, teachers' sharing of projects across teams, and some time to work together in teams, rather than devoted to "new training". The learning of new technology applications were handled in separate workshops open to all Watertown teachers, as a parallel track of MetroLINC activity.

Watertown teachers rated the Watertown-only MetroLINC sessions more moderately, with only about one-fourth or less rating the sessions as "very helpful." At the same time, Watertown teachers were very favorable about the one-on-one contact they received from MetroLINC director, Lisa Breit. In the survey's open-ended item concerning the strengths and weaknesses of MetroLINC, several teachers spoke about what was particularly helpful in the support offered by Breit:

> *Lisa Breit was very good at keeping us informed about dates and timelines. She was also very supportive to me. She always had encouraging words and technology learners really need that. She has made me feel more successful by reminding me of my fears when I first began experimenting with technology. I'm excited and this helps my students because that excitement is passed on to my students.*

> *She has been the greatest resource for me. She responds "immediately" and really listens and understands well. I couldn't have done this without her support.*

MetroLINC teachers rated their contact and communication with ML support staff very favorably, with most Boston and Watertown teachers rating the contact as "very helpful." Boston teachers also spoke about the benefits of staff being supportive and available, and in making each project successful and making sure everyone stays on task. As one Boston teacher expressed, "Help is always a phone call away. You can call someone at the MetroLINC office and you can get phone assistance or they will come to your school to assist you."

MetroLINC Website: The MetroLINC web site was established in Year 2 of the project, and is considered by project directors a central component of the MetroLINC project. During Years 2 and 3 of the project, Boston Adapters were required to post their final curriculum units on the website. During Year 2, teachers described some of the technical difficulties that they experienced, with either logging on in general, or logging on or posting things to this particular site. During Year 3, roughly two-thirds of the teachers viewed the website either somewhat helpful, or very helpful, or looking for additional ideas for their classrooms.

The MetroLINC web site received somewhat mixed reviews from Year 4 teachers, with Boston teachers tending to view the website more favorably than their Watertown counterparts. About one-half (53%) of Boston teachers viewed the web site as at least somewhat helpful, compared with one-fourth (24%) of Watertown teachers. Teachers reported use of the website reflected this mixed review, with only one-third or less (34% in Boston and 21% in Watertown) reporting that they used the web site once a term to get ideas for integrating technology into their classroom instruction. Many teachers (43% of Boston teachers and 68% of Watertown teachers) reported that they never use the MetroLINC website to get ideas for their classroom instruction.

Year 4 teachers' relative lack of use of the MetroLINC website was confirmed by a quick review of the website by evaluators in July 2001. When checking the log-in dates of a sample of 18 Year 4 teachers from Boston, only four of the teachers have logged in during the past six months (three of the four have done so within the past three months), while the vast majority of the remaining teachers appear not to have logged on since about the 2000 Summer Institute. A review of a sample of ten Watertown teachers revealed similar results, with only two of the ten having logged on during the past six months (one during the past three months), while seven have not logged on since last summer, and one having never logged on.

What is not clear is the extent to which Year 4 teachers were actively made aware of the MetroLINC website as a source for ideas for their classrooms. When asked what they viewed as the strengths and weaknesses of MetroLINC, no teachers mentioned the website either as a strength or weakness; it simply received no mention, and thus seems not to be in teachers' general awareness.

It should be noted that unlike past years, Year 4 teachers were not expected to post their final work products produced this year on the MetroLINC website. The products developed by the Year 4 teachers were originally intended to be distributed through a CD-ROM in May 2001, and as of July 2001 could be found off the Boston Office of Instructional Technology website. This is a separate branch that differs from the web-address of the regular MetroLINC curriculum website.

In Watertown, several Year 4 teachers have posted their MetroLINC class projects from this past year on their school's home page. These entries join some of the class archives from past MetroLINC projects that have remained posted on the Watertown school home pages. Thus, from the perspective of the Watertown MetroLINC teachers, it may be that the Watertown school's home pages serve as the main repository for their work to be disseminated to other teachers and the community at large.

A review of the MetroLINC website by evaluators in July 2001 does indicate that the curriculum website portion of the website has experienced some significant additional growth in offerings during Year 4, but primarily by non-Pioneers and Adapters from Years 2-4. During Year 4, according to the date of the posted entry, there were an additional 53 new web tours, 27 new lesson plans, and 9 new curriculum units posted. Of the 50 teachers contributing to these 89 new entries the vast majority were neither Pioneers nor Adaptors, but teachers not part of the project. A number of teachers posted multiple entries, and only 6 were current or former Pioneers (2 from Boston and 4 from Watertown), and an additional handful were former Boston Adapters. Thus, the contributors to the website's curriculum area have largely shifted to a new group of teachers in the district. It seems that there are some new and useful offerings likely to be of interest to technology using teachers in Boston, but that Year 4 teachers have not appeared to avail themselves of these offerings. These new offerings are in addition to the rather voluminous listings of curriculum units and lesson plans from past years.

SECTION II. Sustainable Impact of MetroLINC upon Teachers' Use of Technology and Leadership Roles in Technology

A second major focus of our evaluation effort this year has been investigating the sustainable impact of MetroLINC upon teachers who have participated in the program during its initial years. More specifically, we are examining the effects of MetroLINC participation on teachers' subsequent professional development and classroom practices, and whether the impact of the program is evident even a year or two after participation.

One of the important questions about the outcome of large school interventions such as MetroLINC is whether the relatively modest annual activities and events have a cumulative impact on the ways teachers teach and students learn. Do changes seen in one year carry over to succeeding years? Do teaching strategies change in predictable and consistent ways?

More specifically, we were interested in learning:

- *Are teachers who previously participated in MetroLINC still using computers with their students? Are they using computers more than teachers who have not participated in MetroLINC? How frequent is this use, and in what ways are they using technology?*
- *Are teachers who previously participated in MetroLINC still using the lessons and materials they developed during MetroLINC? Since MetroLINC, are they exercising continued initiative to develop new classroom materials using technology? Are they sharing those materials with other teachers?*
- *How strong is the teacher network that was established through MetroLINC? Are MetroLINC teachers still in contact with other teachers from MetroLINC? Are they using lessons and materials developed by other MetroLINC teachers? Are they using the MetroLINC web site as a resource for classroom ideas and materials?*
- *To what degree are MetroLINC teachers exercising leadership roles in their schools and in the district regarding the use of technology with students? Do their colleagues view them as resources? Are they actively engaged in offering support and guidance to their colleagues in their school, and beyond?*
- *Looking back on their MetroLINC experience, what do teachers perceive as the value of the program?*

Methods and Sample: In this initial round of work looking at past teacher participants of MetroLINC, we focused on four Boston elementary schools that were identified by the Boston MetroLINC project director as having the greatest number of MetroLINC teacher participants. In Watertown, we studied all four Watertown schools (3 elementary, 1 middle school) that have participated in MetroLINC. Follow-up surveys were administered to MetroLINC teachers participating in previous years in these four Boston schools and four Watertown schools.

Our final sample of 42 completed surveys consists of 25 of the 35 Boston teachers and 17 out of 19 Watertown teachers (71% and 89% return rate, respectively). Of the 25 Boston teachers in the follow-up sample, 16 had been a Pioneer for one year or more, while nine had been Adapters for one year. As shown in Table 10, 12 of the 25 Boston teachers have participated in MetroLINC for more than one year; nine of the 12 have chosen to participate this past year as Year 4 teachers. None of the 17 Watertown teachers have participated for more than one year. In addition to administering surveys, we also conducted follow-up interviews and classroom visits to a small set of ML teachers from past years from these eight core schools.

Table 10: Teacher Sample for Follow-up Survey: Breakdown by Yearly Participation in MetroLINC

	Year 2 only	Year 3 only	Multi-Year (including Year 4 participation)
Watertown (n = 17)	3	14	0
Boston (n = 25)	7	6	12 total: Y2 & Y4 (5); Y2 & Y3 (3); Y2, Y3, Y4 (3); Y3 & Y4 (1) (9 are current Y4 teachers)

To include a comparison group, we identified a sample of teachers from these same eight schools who taught comparable grades and subject areas as our MetroLINC "follow-up" teachers. We administered the comparison group survey to 72 teachers and received completed surveys from 39 teachers (28 of the 42 Boston teachers and 11 of the 30 Watertown teachers (67% and 37% return rate).

Findings

Sustainable impact is a concern for any major educational intervention, especially one with both critical mass and range of opportunity. Participants were not only using technology each year of their engagement in the project, but they were also tying the technology use to standards-based curriculum in core subject areas. Initially we want to examine the extent to which teachers have continued to use computers in their classrooms and the level of their technology access. We then turn to the nature of teachers' use of technology in their schools and the degree to which they assumed leadership roles in the area of educational technology use. Teachers also assessed the relative value and utility of different MetroLINC activities and support.

Continued Computer Use

Are teachers who previously participated in MetroLINC still using computers with their students? If so, how frequent is this use?

MetroLINC teachers have access to computers, and they continue to use them: The vast majority of MetroLINC teachers (92 %) reported that they were still using computers with students in their classroom this past year. After excluding the six MetroLINC teachers

who were computer specialists (3 Boston, 3 Watertown) who would clearly still be using computers with students, all of the Boston teachers and three-fourths (79%) of the Watertown teachers are continuing to use computers in their classroom this year.

Of those classroom teachers (excluding computer specialists) continuing to use computers with students, almost all of the teachers (95% Boston, 82% Watertown) are using computers at least weekly. Daily use was higher amongst Boston teachers, with three fourths (77%) of the computer-using Boston teachers reporting daily use, compared with almost one-in-three (27%) Watertown teachers. This difference between Watertown and Boston teachers may be due in part to the different computer access in classrooms between the two districts, with Watertown teachers most typically having only one or two computers in their classroom, making small group work at the computer more difficult. In Watertown, 82% of the teachers are continuing to use computers at least weekly, with 64% of them using computers at least two to three times a week.

(In Boston, it is interesting to note that daily use was higher amongst more recently "inducted" Adapters (89%) than amongst the more technical veteran Pioneers (69%).)

Greater Technology Access
Does the computer hardware profile of MetroLINC teachers look different from non-MetroLINC teachers? Is the computer hardware and software made available through MetroLINC still being utilized by former MetroLINC teachers?

Continued use of computer hardware: When comparing MetroLINC teachers to other teachers, regression analysis showed that follow-up teachers had, on average, at least one more computer in their classrooms than comparison group teachers (means of 3.0 versus 2.0). This difference was found to be statistically significant *($t=3.5$, $p<.001$)*.

During Years 2 and 3 of MetroLINC, local city funds in Boston were used to award Boston Pioneers and Adapters up to four new computers in their classrooms for participating in MetroLINC. Insufficient local funds in Watertown precluded a similar arrangement for Watertown teachers. It appears that many of the computer hardware resources received have remained with the Boston teachers, as intended. Most Boston teachers report ample access to computers in their classrooms with 77% having at least four computers in their classroom and 27% reporting six to seven computers in their classrooms. (This excludes the three computer specialists in the sample.) Only 14% of teachers report having only one or two computers in their classrooms.

While all of the Watertown teachers currently have at least one computer in their classroom, most (86%) indicated that they had only one (64%) or two (21%). Only 14% indicated that they had three or four computers in their classroom.

Thus, the disparity in hardware access in MetroLINC classrooms between the two districts observed in Years 2 and 3 has remained. Most Boston MetroLINC teachers (77%) report having at least four computers in their classroom, compared to only 7% of Watertown

teachers. Similarly, while most Watertown teachers (86%) report that they have only one or two computers in their classroom; this is so for only a relatively small number (14%) of Boston teachers.

(It is interesting to note that this fair amount of computer hardware reported by Boston follow-up teachers is considerably higher than that reported by current Year 4 Boston teachers. These differences are presumably due to the computers received through the MetroLINC program in prior years that were not part of the compensation arrangement in Year 4, coupled with the differing requirements for becoming a Pioneer or Adapter in the different years of the program. In Years 2 and 3, becoming an Adapter or Pioneer required past participation in coaching-coachee programs, which also enabled a teacher to receive one new computer. In Year 4, team grants required the participation of at least five members from a school, and the lead facilitator of the team grant recruited colleagues within the school without requiring teachers to have previously been a computer coach).

Use of the computer lab: We found that most follow-up teachers (87% overall; 94% in Watertown and 82% Boston) report having regular access to their school's computer lab. Perhaps surprisingly, this was somewhat less than that reported by the comparison group teachers in the two districts (100% Watertown, 89% Boston). It is possible that MetroLINC teachers, already having some access to computers in their classroom, are given lower priority for scheduling in the computer labs within the school, to ensure more equitable distribution of computer access in the school.

One might speculate that, since Watertown teachers have fewer computers in their own classrooms than their Boston colleagues, they make more frequent use of their school's computer lab. We found this not to be the case. Boston teachers reported more frequent use of the lab, with 93% reporting that they used the lab at least once a week, compared with 18% of Watertown teachers. More than one-half (55%) of Watertown teachers indicated that they used the lab less than once a month, in contrast to only 7% of Boston teachers. The Boston teachers may want the entire class using computers simultaneously, rather than rely on stations within the classroom.

Continued use of software/special hardware: As part of their participation in MetroLINC, Boston teachers in Years 2 and 3 were able to receive a standard suite of software tools, including a word processor, presentation software, graphics software, and a graphic organizer. Watertown teachers were able to request a "technical wish list," indicating software as well as hardware peripherals such as digital cameras, scanners, and large screen monitors that were deemed necessary for their projects. Roughly two-thirds of both Boston and Watertown teachers report that they have continued to use the software/special hardware that they were introduced to through MetroLINC, either "often" or "all the time." The vast majority of teachers (83% overall; 79% Boston and 88% Watertown) report that they have used either a digital camera or a scanner as teaching resources with their students, with a little more than one-third (37%) reporting at least weekly use.

Use of Technology Resources

Are former MetroLINC teachers using more technology resources with their students than teachers who have not participated in MetroLINC? What kinds of technology resources are teachers using with students?

Regression analysis showed that teachers who have participated in MetroLINC in previous years report that they use significantly more varied technology resources in their classroom with students overall, when compared to other teachers in their schools *(t=3.03, p<. 001)*. These varied technology resources included the use of computer, digital cameras and scanners, different types of software, and the Internet.

Varied uses of computers and other technologies are seen in MetroLINC classrooms: Regarding teachers' use of different software tools, word processing software is the most popular type of software used by MetroLINC teachers (90% overall; 92% Boston and 87% Watertown), with daily use by 42% of teachers (44% Boston and 38% Watertown).

A little over one-half of the teachers reported using presentation software (67% Boston, 56% Watertown). Most Boston teachers (83% and 62%, respectively), and only one-third of Watertown teachers (29% and 37%, respectively) used graphic software and graphing/spread sheet software.

Most teachers (84% Boston, 88% Watertown) report using content websites on the Internet with students, with about one-half (40% in Boston and 47% in Watertown) of teachers report using the sites at least weekly. Interestingly, daily student use of websites was relatively high amongst Watertown teachers (35%), while quite rare amongst Boston teachers (8%). This may reflect the easy Internet access possible for almost all Watertown classrooms, in contrast to the less common Internet access in many Boston classrooms.

Instructional computer software and CD-ROMS were used by almost all teachers (95% Overall) (96% Boston, and 94% Watertown), with two-thirds (67%) of Boston teachers and a little more than one-half (53%) of Watertown teachers reporting at least weekly use. Interestingly, daily student use of instructional computer software and CD-ROMS was relatively high among Boston teachers (33%), while quite low for Watertown teachers (12%). This may reflect the easy Internet access possible for almost all Watertown classrooms, resulting in more use of the Internet (as mentioned above) and less use of instructional software and CD-ROMS.

Technology is used in a variety of subject areas, but primarily language arts and social studies: The initial goals of the project were to increase the use of technology in science and mathematics. However, given the priorities placed upon literacy in both of the districts, our evaluation conducted during Year 2 revealed that much of the focus of Year 2 MetroLINC projects was in the area of language arts and social studies. This continued focus on language arts continued in Year 3, as documented in our Year 3 evaluation report, with about one-half of the teachers focusing on language arts, while less than a fifth focused on science (17%), social studies (17%), and mathematics (10%).

In our current study, we found that follow-up teachers report technology being used as part of a much broader range of subject areas than during Year 4. As shown in Table 10, language arts continues to be the primary subject area of focus for Boston MetroLINC teachers' use of the computer; however, more than one-half of the teachers also report using technology in mathematics, social studies, and science. In Watertown, science was the subject area most frequently cited as incorporating technology, followed closely by mathematics, social studies, and language arts.

Table 10: Primary Subject Areas Addressed by Students' Software and/or Internet Use for Follow-up MetroLINC Teachers

	Language Arts	Science	Mathematics	Social Studies	Other (Includes Art & Music)
Boston (n = 25)	88% (22)	52% (13)	60% (15)	60% (15)	24% (6)
Watertown (n = 14)	43% (6)	57% (8)	50% (7)	50% (7)	50% (7)
Both Districts (n = 39)	72% (28)	54% (21)	56% (22)	56% (22)	33% (13)

This broadening of subject matter focus is confirmed by another survey item, in which about one-half of the Boston teachers and one-third of the Watertown teachers indicated that they are now covering more subject areas when comparing their current use to their original MetroLINC curriculum unit. This resurgence of focus in science and mathematics is notable, given the project's original focus on science and mathematics. This increased focus in science and mathematics was also noted in the team grants and projects addressed by this year's Year 4 MetroLINC teachers.

Continued Use of Previously Developed Materials

Are former MetroLINC teachers still using the lessons and materials they developed during MetroLINC? Are teachers exercising continued initiative to develop new classroom materials using technology? Are they sharing those materials with other teachers?

Previously developed MetroLINC materials appear to have a continued impact on classrooms, with most teachers (87% Boston, 63% Watertown) indicating that they are continuing to use materials that they developed as a MetroLINC participant. Perhaps more importantly, teachers are exercising continued commitment and initiative in their development of new ways to incorporate technology in their curriculum, with most teachers (79% Boston, 69% Watertown) indicating that they are also using new materials that they have developed since MetroLINC.

As noted above, a good number of Boston and Watertown teachers said that they are now covering more subject areas in their current technology use compared to their original MetroLINC curriculum unit. Thus, MetroLINC teachers appear to be transferring their

skills in adapting and creating standards-based curriculum units utilizing technology to additional lessons and to additional areas of the curriculum.

Furthermore, these newly developed materials are being disseminated more widely within the districts, with most teachers (77% Boston, 57% Watertown) sharing with others these additional technology-supported lessons/materials they have developed since MetroLINC.

Building a Community of Practice
How strong is the teacher network that was established through MetroLINC? Are MetroLINC teachers still in contact with other MetroLINC teachers?

To provide a backdrop to examine teachers' collegial relationships in their school, we found that a little more than one-half of all teachers (52%) report that they meet with other teachers to discuss and plan curriculum or teaching strategies at least once a week. This occurred with a somewhat higher proportion of Watertown teachers than in Boston (65% Watertown vs. 44% Boston). While higher proportions of Watertown teachers regularly meet with other teachers, continued contact and communication between MetroLINC teachers appears stronger in Boston than in Watertown.

As we had found in Years 2 and 3, contact between MetroLINC teachers was higher in Boston, which utilized a more formal design team structure of Pioneers and Adapters than had been adopted in Watertown. Most Boston teachers (81%) reported that they have contact with other MetroLINC teachers in their school at least often, compared with about one-half (54%) of Watertown teachers. A fifth (20%) of Watertown teachers reported that they rarely had contact with other MetroLINC teachers in their school, in contrast to only 4% of Boston teachers.

One might hypothesize that this district difference could be due to differences between the districts in school size. For instance, Boston teachers could be working in larger schools and are members of larger faculties than Watertown, and thus find the colleagial MetroLINC relationship forged through MetroLINC even more valuable and actively seek those MetroLINC colleagues out. Alternatively, one could envision that Boston teachers in the sample might be teaching in smaller schools than their Watertown colleagues, and thus would be more likely to run into their MetroLINC colleagues. However, as shown in Table 11, the school sizes in each district varied in size, and the district averages are not dramatically different.

Table 11: School size by district

Watertown	Boston
Elementary School #1: 564 students	Elementary School #1: 604 students
Elementary School #2: 395 students	Elementary School #2: 504 students
Elementary School #3: 269 students	Elementary School #3: 295 students
Middle School: 646 students	Elementary School #4: 242 students
Average: 468 students	Average: 411 students

It appears that the difference between districts has less to do with building size, and may reflect the type of team membership and collegial relationships that were more actively established through the Pioneer-Adapter teams in Boston than in Watertown, and that such relationships have sustained themselves over time. It should be noted, however, that the Boston schools in this study were chosen for having been the most active MetroLINC schools, and that a number of teachers were in fact current Year 4 teachers. Thus, this hypothesis of stronger collegial relationships established in Boston will be one that will need to be tested further in the coming year, as we expand the Boston sample of follow-up teachers beyond these four core Boston schools.

Dissemination Efforts Within MetroLINC
Are former MetroLINC teachers using lessons and materials developed by other MetroLINC teachers? Are they using the MetroLINC web site as a resource for classroom ideas and materials?

The opportunity to learn from other teachers in MetroLINC seemed to be one of the clear benefits of the project. As one teacher expressed, "The most useful aspect of my MetroLINC experience has been the opportunity that I have gotten to see and share in the projects that others in the system are working on."

Actual use of lessons and materials developed by others in MetroLINC was one of the few areas in which there were clear district differences. While about one-half (54%) of Boston teachers reported using materials from other MetroLINC teachers, very few (13%) Watertown teachers did so. What might account for these differences?

First of all, the contact between Boston MetroLINC teachers remained stronger than that between Watertown teachers, as reported above, with the relationships established within Pioneer-Adapter teams appearing to be sustained to some degree.

Second, there may also have been some effect from the different kinds of teachers participating in Watertown versus Boston. The relatively low level of sharing materials between MetroLINC teachers in Watertown may be due to several additional factors:

- Watertown teachers developed units across a much wider range of subject areas than Boston teachers (e.g., core subjects such as language arts, social studies, science and mathematics, as well as special subjects such as art, world languages, and physical education). Furthermore, a relatively high proportion of Watertown teachers were either middle school teachers who specialized in a particular subject, or had specialized roles within the school (e.g., supporting the homework resource room for students, or teachers working within a self-contained classroom with special needs children). Thus, there may have been fewer resources directly relevant to the particular teaching and learning needs of a given Watertown teacher.
- Watertown teachers in the sample were, in effect, all Pioneers who had developed their own unit, rather than also including Adapters who were mentored by their

Pioneers. Thus, in contrast to Boston Adapters and Pioneers who may have continued to view fellow team members as resources of ideas and materials, the Watertown model of Pioneers was more of a "lone ranger" approach (although there were a few teachers who worked in pairs, and their having a more informal arrangement with an Adapter, to whom they were supposed to show their unit.) In Years 2 and 3, MetroLINC teachers in Watertown had mainly spoken about contact they had with the MetroLINC director in Watertown, and possibly a teacher they may have partnered with in their MetroLINC project for those handful of projects, which were done jointly.

Third, the MetroLINC web site was used only sporadically by some teachers to get ideas for integrating technology into their classroom instruction, and more often by teachers in Boston than in Watertown. Only a little over one-half (59% of total, 64% in Boston, 47% Watertown) report ever using the website. Of those Boston teachers who use the website, most report that they use it at least monthly. In contrast, most of the Watertown teachers who have used the website report doing so only about once a term.

A quick review in July 2001 of login records of a sample of follow-up teachers indicated that the MetroLINC website is only being used by a relatively small portion of former MetroLINC teachers. We looked at ten Boston teachers who are not currently Year 4 teachers, four who have logged in the last three months; however of the remaining six, three have not logged in for about a year, and the other three last logged in two to three years ago. (A somewhat similar spread was found for Boston follow-up teachers who are currently Year 4 teachers. Log on records for eight Year 4 teachers revealed that three had logged on in the past six months, four had not logged on for a year, and one had not logged on for two years.) Of the ten Watertown teachers whose log-on records we examined, five last logged on during Spring 2000 (a little over a year ago), while the remaining five have not logged on for about two years.

As stated earlier in the report, a number of new additions were made to the website during the past school year, particularly in the area of new web tours. Thus, it is unfortunate that the former MetroLINC teachers do not seem to be taking advantage of the resources which are available through the site, and that regular use of the MetroLINC website is generally quite low.

Technology Leadership

To what degree are MetroLINC teachers exercising technology leadership roles in their school and in the district? Are they viewed as resources by their colleagues? And do they offer support and guidance to colleagues in their school and beyond?

Teachers who participated in MetroLINC in previous years reported that they provide assistance to other teachers more often, and have been involved in more activities that promote technology use and education within and beyond their school than other teachers in their schools *(t=7.76, p<. 001)*. Regression analysis shows that 43 percent of the

variation in leadership capabilities regarding technology for follow-up versus comparison group teachers is associated with whether or not a teacher participated in MetroLINC.

While sustained contact between MetroLINC teachers appear stronger in Boston, teachers in both districts demonstrate comparable levels of exercising leadership in technology with the broader circle of colleagues in their schools. About three-fourths (74%) of the teachers report that they have collaborated with other teachers on lesson plans that promote technology use and education within their school (68% Boston, 82% Watertown). Almost one-half of the teachers (44% in Boston and 48% in Watertown) say that other teachers within their school come to them for technical advice and information either often or all the time. Almost one-half (48%) of Watertown teachers and one-third (36%) of Boston teachers report that they provide assistance to other teachers who want to use technology in their classroom at least often. Most teachers (84% Boston, 71% Watertown) indicated that they felt either "more comfortable" or "a lot more comfortable" giving such advice to teachers since they participated in MetroLINC.

This leadership by MetroLINC teachers was confirmed by our comparison group teachers. Comparison group teachers were asked to name up to three colleagues to whom they go for advice and information on using technology with their students. A total of 34 teachers (27 Boston teachers and seven Watertown teachers) responded to this question. An index of how much MetroLINC teachers constituted a portion of the technical resources in their schools was calculated by looking at the number of different individuals who were named by the comparison group teachers. Of the 46 different names (32 in Boston, 14 in Watertown) offered by teachers, 65% (30) were MetroLINC teachers. While the six computer specialists serving the schools were naturally amongst those mentioned, the remaining 24 MetroLINC teachers were regular classroom teachers or other specialists who evidently have acquired sufficient technical expertise to be identified as valuable resources by their peers.

A second index was designed to capture the frequency with which MetroLINC teachers were sought out by colleagues for technical advice was derived by looking at the total number of responses generated by the comparison group teachers. Of the 95 responses generated by the comparison group teachers, 76% of the responses were ones who named MetroLINC teachers.

As indicated in Table12, follow-up teachers reported taking part in a wide variety of initiatives indicating growing leadership roles in the area of educational technology in their schools and in their districts. Most teachers assisted other teachers with technology use in their schools. About one-half of the Boston teachers assisted teachers with technology from other schools, served on their school's Instructional leadership teams, and wrote technology grants. Between one-quarter and one-third of Boston teachers reported leading workshops, teaching courses, and making presentations at their schools and at conferences. In Watertown, one-half of the teachers reported making presentations in their schools, while about one-fourth are teaching courses in their school, making conference presentations, and serving on their school's Instructional Leadership team.

Table 12: Teachers' leadership activities, by district

	Boston (n = 25)	Watertown (n = 17)	Total (n = 42)
Assisting other teachers w/ tech use in your school	19 (76%)	12 (71%) +	31 (74%)
Assisting other teachers w/ tech use beyond your school	12 (48%)	5 (29%) +	17 (41%)
Participating in workshops in your school	22 (88%)	15 (88%)	37 (88%)
Participating in workshops beyond your school	16 (64%) +	9 (53%) +	25 (59%) +
Leading workshops in your school	10 (40%)	3 (15%)	27 (39%)
Leading workshops beyond your school	9 (36%)	2 (12%)	11 (26%)
Taking courses in your school	15 (60%)	11 (65%)	26 (62%)
Taking courses beyond your school	6 (24%) –	6 (35%) +	12 (29%) +
Teaching courses in your school	7 (28%)	5 (29%) +	12 (29%)
Teaching courses beyond your school	6 (24%)	1 (6%)	7 (17%)
Participating in on-line courses and listservs	8 (32%)	4 (24%)	12 (29%)
Making presentations in your school	9 (36%) –	10 (59%) +	19 (45%)
Attending conferences	11 (44%)	10 (59%) +	21 (50%)
Making conference presentations	9 (36%)	4 (23%) +	13 (31%)
Serving on school's Instructional Leadership Team (ILT)	13 (52%)	5 (29%)	18 (43%)
Writing Technology Grants	10 (40%) –	3 (18%) –	13 (31%) –

Comparison with Year 4 teachers: + marks an increase in excess of 10 percentage points
– marks a decrease in excess of 10 percentage points

Follow-up teachers also continued to exercise additional initiative to participate in workshops and courses other than those offered by MetroLINC. Most teachers (88%) indicated that they had participated in technology-related workshops in their school, and many (62%) had taken courses in their schools as well. Teachers reported a somewhat higher frequency of taking advantage of professional development opportunities offered right in their schools, as opposed to events offered outside of their schools, although conference attendance was quite high (50%). About one-third of the teachers also reported participating in online courses or listservs.

When comparing the responses of the follow-up teachers with the Year 4 teachers, there were a number of differences in level of leadership activity. Differences were noticeable for the Watertown teachers, who reported higher levels of leadership activities in eight

areas (assisting teachers in technology in your school and beyond your school; participating in workshops and taking courses beyond your school; making presentations and teaching courses in your school; and attending conferences and making conference presentations), while only decreasing in one area (writing technology grants).

Perceived Value and Impact of the MetroLINC Program
Looking back on their MetroLINC experience, what do teachers perceive as the value of the program?

Most of the teachers (88% Boston and 82% Watertown) expressed that they felt that MetroLINC was a useful catalyst in their development as a technology-using teacher.

When asked how MetroLINC had been a useful catalyst, several teachers described the ways in which it increased their comfort and confidence with using computers and working with others:

> *Through working with my pioneer, I feel a lot more comfortable with the computer. I take more risks – try new things.*
>
> *Opportunity for gaining confidence through experience*

As with the Year 4 teachers, a number of follow-up teachers talked about the benefits of working as part of a larger group and community of technology-using teachers:

> *It allowed for interaction among teachers around a common theme, something that would not have happened otherwise.*
>
> *It was useful to design a project with another teacher.*
>
> *I met people outside of my school who have been valuable contacts.*

Others acknowledged the importance of receiving computer hardware, as well as the value of a concentrated effort on a project that encouraged a different kind of experimentation and risk-taking:

> *It allowed hardware, software, and technical skill development that would have taken much longer to achieve. It provided a valuable resource for continued development.*
>
> *Giving me the equipment to be able to learn more about technology. Giving me the support and encouragement to explore the unknown.*
>
> *MetroLINC gave me the tools that enable me to use technology in the classroom. It also motivated and inspired me to do more with technology.*

> *I was able to interact with Lisa Breit who always had advice, new ideas, and inspiration to offer. One person can make a program work, and Lisa pushed, prodded and encouraged me to think outside of the box, and realize some of the ideas I had.*

A few teachers also talked about how they valued the opportunity to share their experiences and expertise with a broader audience:

> *Opportunity to show [people in my department] and administrators, parents, and kids how technology can be used to promote curriculum goals and state standards/frameworks.*

> *I became more comfortable in presenting and teaching others*

Teachers report that they still have some continued contact with MetroLINC staff. Teachers in the two districts report roughly comparable levels of contact with MetroLINC staff for technical assistance and advice, with 48% of Boston teachers and 35% of Watertown teachers reporting that they had such contact at least monthly.

Does the degree to which teachers used MetroLINC resources have an impact on their subsequent technology use and leadership capabilities in technology?

Correlation analysis showed that the "extent to which previous MetroLINC teachers use the resources and support provided through MetroLINC" to be positively and moderately to highly associated with the extent to which teachers use varied technology resources with their students *(r=. 62, p<. 001)*, and their leadership capabilities related to the use of technology *(r=. 58, p<. 001)*.

Regression analysis showed that 39 percent of the variation in the extent of use of varied technology related resources and 34 percent of the variation in teachers' leadership capabilities is associated with variation in the extent to which teachers used special hardware they were introduced to through MetroLINC, the extent to which teachers had contact with other MetroLINC teachers, contact with MetroLINC staff for technical assistance, and the extent to which they used the MetroLINC web site to get ideas for integrated technology into their classrooms. A higher score on these dimensions is associated with more frequent use of varied technology related resources for teachers who participated in MetroLINC in previous years.

We have seen clear evidence that the initiatives of the first several years have been important for the participating teachers, that they have evolved their classroom practice as a consequence of MetroLINC, and that their efforts have paid off in recognition and leadership roles.

SECTION III: Continuing Studies on MteroLINC Partnerships and Student AcademicAchievement

Findings

On-going Studies: Two additional studies were also initiated during Year 4, which will extend into Year 5. These studies are an examination of the various partnerships that have been pursued by MetroLINC directors and several non-profit organizations and higher education institutions in Boston, and a pilot study on the possible effects of MetroLINC teacher participation on subsequent student achievement. Findings from these two studies will be available in our Year 5 report.

Below we start with a discussion of the initial partnerships, included as elements of the original proposal. That is followed by a discussion of our plans and expectations for—but not the results of—assessing academic progress and achievement as it relates to teacher participation in MetroLINC.

MetroLINC Partnerships Study

This study is examining a variety of partnerships with outside organizations that have been initiated and/or implemented by the MetroLINC staff in Boston and Watertown. Partnership development and sustainability are key for Challenge Grant (and other) projects such as MetroLINC if they are to become institutionalized beyond the funding period. Understanding the barriers and facilitators to building robust partnerships is critical. During Year Four, the major focus of the study has been a retrospective look at several partnerships that had been written into the original proposal and initiated early in the course of the project. These partnerships were less successful than the partners had either envisioned or hoped, and we were interested in learning what made them so. We interviewed the MetroLINC project directors from both Boston and Watertown as well as representatives from the Boston Museum of Science and Education Development Center, Inc. (EDC). These interviews were designed to help us identify what, from the perspective of the different role groups, are necessary elements to building viable partnerships, and to identify barriers that prohibit such partnerships from developing fully. Recommendations emerging from this study are valuable for subsequent projects and organizations as they work to develop healthy collaborative relationships.

Museum of Science.

While both the Watertown and Boston Public Schools had relationships with the Museum of Science prior to MetroLINC, at the time the Challenge grant was funded, Watertown was very directly involved with the Museum of Science through a National Science Foundation grant linking schools and science museums. Watertown's Hosmer Elementary School was actively involved with the Science Learning Network and was a lighthouse

school for the state before the Challenge grant was awarded. According to Watertown's project director, Lisa Breit, "We were ahead of the curve with Hosmer." Many of their teachers were already using technology throughout their curriculum in conjunction with this work. The Challenge proposal indicated that the Hosmer experience and model would be used to "jumpstart" the overall project. This did not really happen as proposed.

During Year One, MetroLINC staff from both Boston and Watertown began meeting with Museum of Science staff to plan the Summer Institute that would be held at the end of the first year of the project. All of the participants interviewed agreed, in retrospect, that there was no clear agreement at the time on what the relationship of the three partners would be, and how they could work together to everyone's benefit. As one of them put it, "We were at loggerheads right away."

Watertown had the belief that the partnership would focus on research and model building for how to integrate technology into science teaching and learning. In Boston, the issue of scalability throughout the whole school system influenced all of their thinking and planning, and a "train the trainer" model, or any structure that would allow a scaling up to reach, potentially, all K-8 teachers in the large Boston system was of paramount importance. Shared focus and goals were not clear to any of the partners.

Eventually, the first Summer Institute as run by the Museum of Science was a week-long session for teachers on integrating science and technology. While the Museum of Science is nationally known for its science programs, technology training is not its particular area of expertise. Teacher feedback from the Institute was not positive, and the second year, during which there were a number of personnel changes at the Museum of Science, did not offer a subsequent training institute.

However, there were attempts to restructure the partnership and provide training and support in ways that might be more useful to teachers. The Museum of Science proposed a teacher sabbatical program, which would have focused on standards and how to teach to standards. The teachers involved would have gone to monthly trainings, and then attended an intensive summer training institute. However, Boston Public Schools would not agree to the monthly pull-out sessions for teachers, particularly as this program could only be made available to a small group of teachers rather than open to all. While the smaller Watertown Public Schools were interested and ready for this program, the Boston Public School system, with its complicated bid process, was in charge of the overall project budget and could not move quickly enough to make the program available for Watertown alone.

In Year Three, there were more planning meetings with the Museum of Science, "but nothing ever got off the ground," according to one of the attendees, and eventually the attempts to build a viable partnership were dropped as "there are only so many mountains that can be moved." But through the process of trying to work with the Museum of Science, Boston Public School science department heads worked together with the MetroLINC staff, bolstering a partnership within the Boston system itself.

Education Development Center, Inc.(EDC)

Make It Happen, described in the proposal as MetroLINC's "key software", had been developed by EDC prior to the grant award. Its "question, research, reflect, and express" inquiry-based approach was designed to help students conduct research projects. The software included a search organizer to help students with the "I-Search" process. EDC had developed *Make It Happen* for the Macintosh and for grades 6-8. The proposal indicated EDC would develop a PC version and also expand the program to include lower grades. As with the Museum of Science partnership, during the first year of the grant, everyone was "trying to find his or her focus." There was a perception that EDC, Watertown, and Boston were all operating under different sets of assumptions, with different models of what the work was and what it should look like.

EDC did the software conversion of *Make It Happen* and ran an orientation presentation for teachers near the end of Year One to get them interested in using the software. The Boston Public School teachers liked the "I-Search" process, but felt that the software itself was cumbersome, and that they were already conducting a lot of the search organizing process without the software. It was felt that using *Make It Happen* in Boston would have been an issue of bringing yet another methodology to the system when the teachers already had enough. Training on *Make It Happen* was offered for Boston and Watertown teachers during the summer of Year One, but only a few Boston teachers signed up. EDC offered additional training the following summer; only Watertown teachers attended.

There had been some preliminary examination to see if *Knowledge Navigator*, another software product available from EDC, would be a useful software tool for MetroLINC teachers, but at the end of Year Four, the EDC partnership appeared to be on hold.

Early Lessons Learned – Initial Recommendations.

What went wrong? Both the Museum of Science and EDC were proposed to be vibrant, vital partners in the MetroLINC consortium. What, if anything, could have helped these organizations form robust partnerships that could have benefited all the partners?

One piece of the project history that seems important, particularly for partnership development, is the fact that neither the Boston or Watertown project director had been involved in the actual proposal writing; both had come on board after the project had been funded. Neither of them may have had a compelling sense of ownership of all the details of the proposal as written. Boston MetroLINC project director, Alice Santiago, for example, felt that much of the Museum of Science focus was built around its existing relationship with the Watertown Public Schools, and there was not a comfortable, scaleable "fit" for the Boston Public Schools in the proposed model.

Another consideration is that the MetroLINC proposal had a great many foci; development of partnerships, not only externally but internally as well, was only one of many and may

not have been viewed as a high priority. Lisa Breit believed, "If we had made partnership more of a focus, we could have been more committed, could have been clearer about what to do. We could have had a great opportunity for kids from different school districts to work together. It could have been wonderful."

In addition to multiple foci, the proposal included multiple partners. One partner recommended that the partners "should not be a cast of thousands" but a few, very carefully chosen partners with a "clear plan about what the partners are doing." A clear plan might have allowed all the partners to see a way that the Museum of Science, for example, could have been better used to exemplify technology integration by teaching technology applications in the context of content-area instruction. This would have required additional planning and integrated efforts on the part of both Museum of Science and MetroLINC staff.

The issue of scalability did not get raised early enough or realistically enough in the grant, and it became a very significant issue in matching project activities with a large school system such as Boston. Given the limited size and time frame of the grant, it is possible to "seed" innovative classroom practices in a number of classrooms and learning environments, but it is not possible to overhaul the whole system.

The project was overly ambitious and there was a long learning curve.
All of the partners interviewed expressed beliefs similar to these made by one of them: "Once you get the grant, you need to open up discussion and start again, structure together…. It takes enormous effort." Alice Santiago's comments define much of what goes into a partnership: "One thing I've learned is that partnerships take a long time to develop. It's all about trust; it's all personal. It's been a real education."

Recommendations to help organizations structure together to develop functional partnerships are all based on improved communication and include the following:

- A facilitator is needed to help move the process along, and communication needs to be a much higher priority than it frequently is.
- Co-planning needs to be built into the work plan; there needs to be a clear plan and carefully delineated checkpoints at which all partners can regroup and change structures and plans if necessary.
- "Graceful exit points" need to be built in if partnerships are not developing as hoped or planned.
- If the partners are not equal in power or decision-making, that needs to be acknowledged out and up front.
- Partners need to design their joint venture together with an underlying theory, an approach they advocate, and a clear outcome.
- Partners need to articulate their assumptions and be straightforward with and respectful of each other.

While many federal funding agencies, including the U.S. Department of Education, require projects to have partners, they don't articulate why partners are important. We need to probe what relationships do, and look for potential partnerships that are not so far apart

that they can't work.

Impact on Student Achievement: Past and Continuing Efforts

This year we embarked on a study of the possible effects of MetroLINC teacher participation on subsequent student achievement. We have been working to collect data that includes grades, attendance records, and student achievement test scores, including the SAT-9, SRI, and MCAS in Boston and the SAT-9, and 8th grade MCAS and Explore tests in Watertown. We have been focusing on collecting data for the 1998-1999 and 1999-2000 academic school years and targeted four Boston schools with the highest MetroLINC participation, and three of four Watertown schools participating in MetroLINC. We targeted MetroLINC teachers who have taught in the particular grades in which these tests are administered in the two districts.

Despite considerable efforts since January to obtain test scores from the two districts, including an initial letter to administrators, the signing of an agreement with the Boston schools, phone contacts with key personnel within each Watertown school, and emails detailing precisely what student information is needed, for which schools and for which teachers, we have encountered continual challenges in securing data from the two districts. The biggest obstacles have been the extent to which records are maintained and how records are kept at the school level in Watertown and at the centralized office at the district level in Boston. Some schools in Watertown have grades or attendance records, and test scores, and others do not. In Boston, where student assessment data is maintained at the district level, test scores are identifiable by student name and id, and cannot be identified by teacher. As a result of these obstacles, we were not able to obtain the needed scores for analysis this past spring, as initially planned. We have extended conducting this student achievement study into Year 5. Information we have gained from our contact with the districts this past year has informed our revised plans for what data will be obtained in Watertown and how data will be obtained in Boston.

Based on our revised plan for Year 5, we will be able to track the students of 19 different MetroLINC teachers (16 in Boston & 3 in Watertown), drawn from six different schools (4 in Boston & 2 in Watertown). We will be working directly with administrators at each school in Boston to obtain information on the students who were in the classrooms of our MetroLINC teacher sample. This information will allow us to obtain the student data for these teachers (identified by student name and id) from the Office of Research, Assessment, and Evaluation in Boston, and will also allow us to use test data on the remaining students as part of our control group. In addition, we were informed that student test data will be available for more grades in Boston then we had originally thought. This will allow us to increase our sample and examine the academic achievement of students in the classrooms of more MetroLINC teachers. Because we are now continuing our efforts into Year 5, we will also target students who were in the classrooms of MetroLINC teachers this past year (2000-2001), as well as for the 1998-1999 and 1999-2000 school years. Table 13 shows the number of MetroLINC teachers for whom student achievement data should be available by year and will be sought in each district.

To date, we have successfully obtained SAT-9 test scores and attendance records from one of the Watertown schools (grades not available) and student grades from another (attendance records not available). We will also continue our endeavors in Watertown, but will only obtain and use scores for the grades and tests that comparable data will also be available from Boston. As Table 13 shows, 3rd grade SAT-9 test results are the only scores available in Watertown that are also available in Boston. We will not have a big enough sample to conduct statistical tests of differences for the grades and tests that are available for Watertown (Explore and 8th Grade MCAS) and not Boston.

Table 13: Number of MetroLINC teachers for whom student achievement data should be available (By year, test, and grade)

	1998/1999		*1999/2000*		*2000/2001*		
	Boston	Watertown	Boston	Watertown	Boston	Watertown	**Total**
SAT-9							
3rd grade	2	0	5	2	4	1	**14**
5th grade	3	0	6	NA	3	NA	**12**
SRI							
4th grade	NA	NA	NA	NA	4	NA	**4**
5th grade	NA	NA	NA	NA	3	NA	**3**
6th grade	NA	NA	1	NA	2	NA	**3**
MCAS							
3rd grade	NA	NA	NA	NA	4	NA	**4**
4th grade	3	0	5	0	4	0	**12**
6th grade	NA	NA	NA	NA	2	NA	**2**

We are making slow but steady progress and plan to conduct analysis on these data during the fall or spring. Currently, our plans for analysis include examining the impact of MetroLINC on students by test and by grade. It is important to note that the final analysis conducted will depend primarily on the final sample we have available to us by test, grade, and district. The sample size criteria appropriate for inferential tests will determine the various analysis techniques used and whether or not it is possible to look at the impact of MetroLINC on students by district or only for both districts overall.

SECTION IV: Conclusions and Recommendations

Based on the data we collected and analyzed, and our continuing explorations of the MetroLINC project, we can point to some clear findings about how MetroLINC teachers engage technology in their classrooms. Further, we have some recommendations for consideration as the program enters its final year.

Conclusions

Access to computers is not increasing as quickly as it was in the past, since receiving new computers are no longer a core part of the incentive structure for Boston teachers participating in MetroLINC. Nevertheless, MetroLINC participants in both Boston and Watertown have greater access to computers, peripherals, and software than do other teachers in their districts.

Classroom access to the Internet is also greater for MetroLINC participants than for others in their districts. The degree to which this access finds its place in instruction is not presently known. And participating teachers also have access to—and use—a broader range of technology resources and software.

Teachers are using technology to support teaching of standards-based curriculum, across a range of subject areas. In contrast to the heavy focus on Language Arts in past years, teachers are reporting an increased use of technology in science and mathematics. This is a notable resurgence, given the project's original focus on science and mathematics. Literacy also continues to be a primary subject area emphasized, given the two districts' priorities in this area.

Teachers' knowledge of technology and how to use it are growing as a consequence of participating in MetroLINC. Professional development efforts have focused on preparing teachers to use technology in their curriculum, but less on broader curriculum and assessment issues.

The collaborative elements within each district's MetroLINC initiatives are powerful benefits for the teachers. They see great value in the opportunity to share, learn, and be part of a community of practice.

There is clear evidence that MetroLINC has created a cadre of school building leaders who, through their increased skill with technology, are sought out for information and assistance. These are teachers who conduct training, make presentations, and work with other teachers to develop skills in using technology in the classroom.

The MetroLINC website appears to be an under-utilized resource, with few of the participating teachers turning to the site for information or for adding materials and lessons to the existing database. Because it is not a place that teachers regularly visit, it is quickly forgotten unless a specific piece of information is needed.

Most teachers are continuing to use units they developed through MetroLINC, as well as to develop new technology-oriented units of their own. The Boston MetroLINC teachers have, over the past two or three years, adapted and adopted materials developed by others in the project. Watertown teachers, having developed a more diverse set of units as part of their efforts, were less likely to adapt materials that other MetroLINC teachers created.

At this point, we have not been able to undertake an analysis of academic achievement data for the two districts. We expect, and hope, that these data will be provided and the analysis can be conducted in the 2001-2002 school year.

While we have only preliminary studies underway, we can see that the initial partnerships between the MetroLINC project and other organizations, and those initiated by the two districts independently, did not prove successful for several reasons. These include differing agendas; difficulty in planning mutually agreeable timelines, schedules, and objectives; and the need to commit to making a partnership succeed beyond the self-interests of the individual partners. Continuing studies will provide further information in the final year of the project.

Recommendations

The ideas below are offered for consideration to the two districts involved in the MetroLINC project. These suggestions range from support for additional technology access to staff development to collaboration and recognition. All are designed with the notion of scaling the existing initiatives to reach more teachers and of sustaining the project successes, accomplishments and newly developed staff leadership capabilities. There are additional ideas that can be shared with the project as opportunities arise.

- Efforts to increase the number of classroom computers would be well received by teachers and, based on prior initiatives, a quid pro quo of teacher efforts to master skills or develop materials in return for computers is still a bargain that teachers are willing to make. Computer upgrades, and enhanced hardware peripherals would also be positively received. We do recognize the budgetary constraints on this, but would suggest corporate or foundation support to further this effort.

- The addition of AlphaSmarts in elementary schools will distribute access more broadly than would waiting for large numbers of full-function computers. And the AlphaSmarts would focus teacher efforts on the literacy issues still central to the district.

- Curriculum-focused staff development that incorporates technology would also be welcomed. It would identify resources that relate to standards-based curriculum and can be confidently used within the classroom. In addition, it would further develop technology skills and strategies that are grounded in the curriculum and could be transferred to the classroom.

- Both districts should continually seek opportunities for teachers to share with one another about their uses of technology in the classroom and in support of curricular goals. Informally, within a school building, or through scheduled events, teachers' perception of their own isolation can be ameliorated though the sharing of ideas. Assigning technology leaders within a building to facilitate some site meetings would benefit the entire school.

- Since the website appears to be used more by non-MetroLINC teachers, perhaps there can be a recruitment effort to tie these newcomers into the network of existing MetroLINC participants. Kicking out an email to the MetroLINC leader in a school when one of the teachers in that school posts to the site might be warranted. Inviting the new "posters" to MetroLINC events or a special invitation to district technology events could also bring them into the fold.

- MetroLINC teachers should be continued to encourage to present their work at local, state and national conferences and forums. Support for writing grants and for dissemination efforts should be offered from the districts. The project should seek ways that they can acknowledge the leadership efforts of MetroLINC participants, through certificates of appreciation, recognition in district publications, or with gifts and incentives such as software or peripherals.

- Establishing functional partnerships between school districts and other education organizations can be greatly enhanced through improved communication and planning. For example, co-planning needs to be a high priority and built into the work plan; there needs to be clear plan and carefully delineated checkpoints at which all partners can assess their progress, regroup and change structures and plans as necessary. Similarly, "graceful exit points" need to be built in if partnerships are not developing as hoped or planned.

About the Research Team

This research study was conducted by ROCKMAN *ET AL*, an independent research and consulting firm, specializing in technology and education. The company consults with corporations, state and federal agencies, and educational organizations on research, evaluation, and policy development that advance the application of technology to meet educational and business learning needs.

Current and recent clients of ROCKMAN *ET AL* include: Apple Computer, Autodesk, California Department of Education, Children's Television Workshop, Compaq Computer, Indiana's Buddy Project, Indiana Department of Education, Microsoft, National School Boards Association, Scholastic, Public Broadcasting Service, Toshiba, and numerous US Department of Education and National Science Foundation projects ranging from Technology Innovation Challenge Grants to NetDay to Bill Nye, the Science Guy.

The offices of ROCKMAN *ET AL* are located in San Francisco, California, Chicago, Illinois, and Bloomington, Indiana; the company has working relationships with contractors, university faculty, and consulting groups in all regions of the country.

Further information about this study can be obtained from:

ROCKMAN *ET AL*
605 Market Street, #305
San Francisco CA 94105
415/543-4144
FAX 543-4145
info@rockman.com
www.rockman.com