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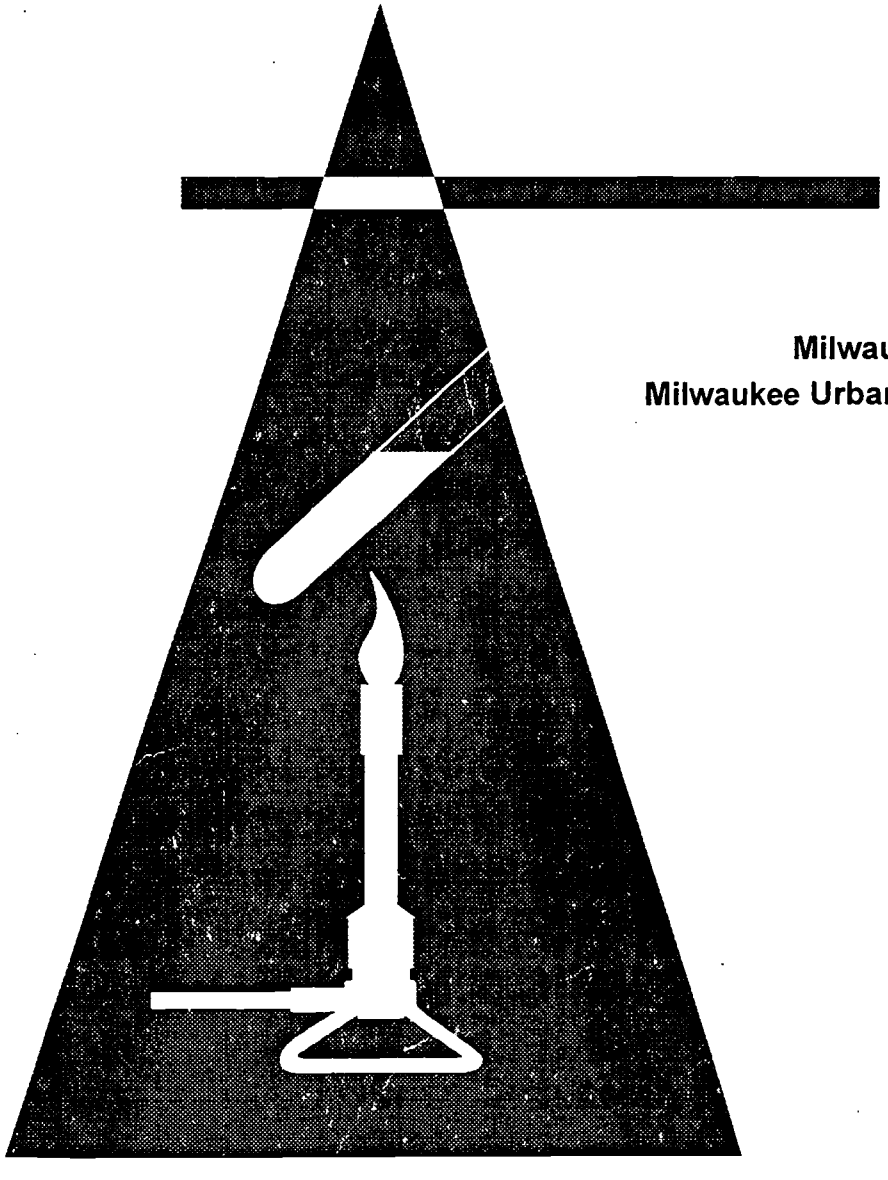
ABSTRACT

The Urban Systemic Initiatives (USI) program is an effort sponsored by the National Science Foundation (NSF) that targets large urban school systems with the goal of sustainable implementation of high-quality, standards-based teaching for the purpose of attaining system-wide increases in students' learning of challenging mathematics and science. The Milwaukee Public Schools joined USI in 1996 with Milwaukee Urban Systemic Initiative (MUSI). The purpose of this report is to provide formative data on MUSI. A survey was given to all teachers who taught mathematics and science in First Wave MUSI schools, in fall 1996. A follow-up survey was then given at the end of two years in spring 1998. Presented are the results from the initial and follow-up surveys that were given to the First Wave MUSI schools. Appendices contain a list of the First Wave Schools and the survey instruments used for elementary mathematics and science; middle and high school mathematics; and middle and high school science. (ASK)

Survey Results for First Wave Schools of the Milwaukee Urban Systemic Initiative



Report on
Milwaukee Public Schools
Milwaukee Urban Systemic Initiative

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August 1999

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Contents

Introduction

The Milwaukee Public Schools (MPS) joined with the National Science Foundation in 1996 to begin the Milwaukee Urban Systemic Initiative (MUSI). MUSI goals reflect a broad spectrum approach for improvement in mathematics and science education. Collaborative vision setting, high standards and performance assessments, narrowing achievement gaps, development of high-content, inquiry-based technology rich curriculum, and breaking down the boundaries between community and classroom serve as a framework within which MUSI operates.

The purpose of this report is to provide formative data on the Milwaukee Urban Systemic Initiative. It presents the results from the initial and follow-up surveys that were given to the First Wave MUSI schools.

Participants

In fall 1996, fifty-two schools were selected as the First Wave MUSI schools (See Appendix A). A survey was given to all teachers who taught mathematics and science in these schools in the beginning of the year. A follow-up survey was then given at the end of two years in spring 1998. Table 1 shows the number of teachers responding to each survey. Although the sample size is comparable at both the middle and high school levels, at the elementary level nearly twice the number of teachers responded for to the follow-up survey than for the initial survey.

Table 1. Number of Teachers Responding to each Survey

Level and Subject Area	Teachers Responding on the Initial Survey	Teachers Responding on the Follow-up Survey
Elementary School Mathematics and Science	423	283
Middle School and High School Mathematics	131	113
Middle School and High School Science	108	90
Total Number	662	486

Procedures

Three survey instruments were utilized: (a) elementary school mathematics and science, (b) middle and high school mathematics, and (c) middle and high school science. Appendix B contains the follow-up surveys. The surveys contained scaled-response and open-ended items. The initial and follow-up surveys were similar with many parallel items; each also contained unique items. Appendix B contains copies of the follow-up surveys. For ease of discussion the initial survey will be referred to as the pre-survey and the follow-up survey as the post-survey.

The surveys were administered through the MPS Department of Research and Assessment. The surveys were sent to each school. They were to be completed by all teachers of mathematics and science within the school. Then the surveys were returned to this department.

Frequencies were found for each of the scaled-response items by level and, where appropriate, means were calculated. The results for the scaled-response items for both surveys are presented within the following six categories: (1) Instructional Practices, Supplies, and Time; (2) Assessment Practices; (3) Technology; (4) Knowledge, Perceptions, and Beliefs; (5) Student Expectations and Policy; and (6) Professional Development and Collaboration. The open-ended items asked teachers to identify the biggest impact of MUSI on mathematics and science instruction and to comment on the support provided by the MSRTs. The responses to the open-ended items were analyzed for recurring themes and patterns.

Mathematics Results

This section contains the results from the scaled-responses on the elementary, middle, and high school surveys in mathematics and the open-ended item regarding impact of MUSI on mathematics instruction. Frequencies are given for each of the scaled-response items by level, and where appropriate, the means are also reported. The open-ended responses were categorized by emergent themes.

Instructional Practices, Supplies, and Time

Teachers were asked to report on the frequency that the instructional practices listed in Table 2 occurred in their teaching of mathematics. When comparing pre/post-survey responses to the inquiry regarding utilization of small groups or pairs of students in the instruction of mathematics, small changes are noted at both the elementary and middle level. However, at the high school level, a greater change is evident. Interestingly, from pre-survey to post-survey, an increase of 10 percent of teachers reported that they use small groups or pairs once or twice a semester. Despite this increase, students at the high school level were more likely to work in pairs or small groups after the second year of MUSI than students at other levels. Forty-five percent of high school teachers reported on the post-survey that they used small groups or pairs daily in the instruction of mathematics compared to the pre-survey response of 35 percent. High school teachers who had infrequently used small groups as a teaching method on the pre-survey (28 percent) appear to have changed the frequency (either more or less) of using of small groups as an instructional method. Only 7 percent of high school teachers reported using small groups infrequently during mathematics instruction on the post-survey.

Table 2. Frequency of Instructional Practices in Mathematics

Item	Grade Level	n	Frequency Percentages				
			Never (1)	Once/Twice a Semester (2)	Once/Twice a Month (3)	Weekly (4)	Almost Daily (5)
Students work together in pairs or small groups on mathematics problems or tasks.	K-5 pre	423	1.4	4.3	18.0	42.8	33.6
	post	283	1.8	3.5	16.3	47.3	31.1
	6-8 pre	85	2.4	1.2	21.2	43.5	31.8
	post	70	0.0	1.4	24.3	35.7	38.6
	9-12 pre	46	4.3	0.0	28.3	32.6	34.8
	post	42	7.1	9.5	7.1	31.0	45.2
Students use manipulative materials to help them understand math concepts.	K-5 pre	426	1.6	5.4	18.1	38.5	36.4
	post	282	.7	2.5	11.7	46.8	38.3
	6-8 pre	85	3.5	11.8	41.2	32.9	10.6
	post	71	4.2	14.1	26.8	47.9	7.0
	9-12 pre	46	15.2	28.3	26.1	21.7	8.7
	post	41	22.0	26.8	22.0	19.5	9.8
Students make conjectures and explore different methods to solve mathematics problems.	K-5 pre	423	4.5	8.0	19.6	40.4	27.4
	post	281	2.8	5.0	20.3	42.3	29.5
	6-8 pre	85	7.1	7.1	20.0	41.2	24.7
	post	70	2.9	2.9	28.6	55.7	10.0
	9-12 pre	46	10.9	8.7	19.6	37.0	23.9
	post	41	4.9	4.9	41.5	39.0	9.8

Manipulatives were used more often by students at the elementary level (85 percent weekly or daily) at the end of the second MUSI year compared to the pre-survey response of 75 percent. However, an increase on the post-survey at the middle level (48 percent weekly use compared to 33 percent on the pre-survey) corresponded to a decrease of 14 percent of middle level teachers who used manipulatives once or twice a month on the pre-survey. At the high school level, pre-survey (15 percent) responses indicated that the percent of teachers who never used manipulatives increased by 7 percent on the post-survey (22 percent).

Middle level teachers increased the amount of time students make conjectures and explore different methods to solve mathematics problems after the second year of MUSI. This increase was reported by middle school teachers who had responded on the pre-survey that they "never" or "once/twice a semester" had student's make conjectures. Nearly 10 percent of teachers reported increasing their use of conjectures on the post-survey.

Table 3 shows the frequency that informal learning environments were used for learning mathematics from pre-survey to post-survey. Elementary students were the most likely to visit informal learning environments throughout the year. Most often the use of informal learning environments was used once or twice a year. At the elementary, 52 percent of the teachers reported using them one or two times per school year on the post-survey compared to the pre-survey of 40 percent. At the middle level (47 percent), teachers were more likely to use informal learning environments one or two times per year after participation in the MUSI project compared to the pre-survey (37 percent). About 10 percent of high school teachers utilized informal learning environments from three to five times post-survey as compared to two percent on the pre-survey.

Table 3. Use of Informal Learning Environments for Mathematics in 1995-96

Item	Grade Level	n	Frequency Percentages				
			Never (1)	1-2 Times (2)	3-5 Times (3)	6-8 Times (4)	9 or More (5)
Students visited informal learning environments as part of the mathematics program during the 1995-96 school year.	K-5 pre	419	34.8	39.9	16.9	5.3	3.1
	post	283	25.8	51.6	17.0	2.8	2.8
	6-8 pre	81	45.7	37.0	11.1	3.7	2.5
	post	71	43.7	46.5	7.0	1.4	1.4
	9-12 pre	46	65.2	26.1	2.2	2.2	4.3
	post	42	64.3	21.4	9.5	0.0	4.8

Table 4 shows the change in frequency at which needed consumable and non-consumable supplies were purchased by the school for use in mathematics. The greatest pre-survey to post-survey change is reported by middle level teachers. On the pre-survey, 31 percent of middle level teachers reported that schools bought few consumable supplies and 8 percent reported that all consumable supplies were purchased. However, on the post-survey, only 17 percent of middle level teachers reported that few of the consumable supplies were purchased and 13 percent reported that all consumables were bought by the school. At the high school level, teachers were more likely to report on the pre-survey that some or most of the needed consumable supplies were purchased compared to the post-survey responses that indicated schools were more likely to purchase all or few of the supplies. Non-consumable supplies were reported to be purchased by schools more often at middle level on the pre-survey and by the high school level on the post-survey.

Table 5 shows the change from pre-survey to post-survey in satisfaction for time available to teach students mathematics. At the high school level, the pre-survey mean (3.13) increased on the post-survey (mean of 3.63). Nearly 25 percent more high school teachers (68 percent)

reported on the post-survey that they agreed or strongly agreed that there was adequate class time for students to learn mathematics compared to the pre-survey (43 percent). Elementary school teachers reported a change in their satisfaction from pre-survey to post-survey also. Elementary teachers reported an increase in satisfaction from pre-survey (63 percent) to post-survey (77 percent).

Table 4. Consumable and Non-Consumable Supplies for Mathematics

Item	Grade Level	n	Mean (SD)	Frequency Percentages None (1)	Few (2)	Some (3)	Most (4)	All (5)
How many needed consumable supplies are regularly purchased by your school for use in mathematics?	K-5 pre	422	2.94 (1.15)	12.8	22.0	32.9	23.0	9.2
	post	281	2.93 (1.11)	12.1	22.4	32.7	26.0	6.8
	6-8 pre	84	2.87 (1.14)	10.7	31.0	27.4	22.6	8.3
	post	70	3.11 (1.22)	12.9	17.1	28.6	28.6	12.9
	9-12 pre	45	3.40 (1.10)	8.9	6.7	33.3	37.8	13.3
	post	42	3.64 (1.16)	4.8	11.9	26.2	28.6	28.6
How many needed non-consumable math supplies are available in sufficient quantity for student use?	K-5 pre	425	3.57 (1.03)	3.3	12.2	26.6	39.8	18.1
	post	283	3.54 (0.93)	0.4	15.2	28.6	41.7	14.1
	6-8 pre	85	3.75 (1.14)	1.2	9.4	22.4	47.1	20.0
	post	71	3.51 (0.95)	1.4	12.7	35.2	35.2	15.5
	9-12 pre	46	3.63 (0.93)	0.0	15.2	21.7	47.8	15.2
	post	42	3.76 (1.01)	4.8	4.8	21.4	47.6	21.4

Table 5. Teacher Satisfaction with Time Available for Mathematics

Item	Grade Level	n	Mean (SD)	Frequency Percentages Strongly Disagree (1)	Disagree (2)	Neutral (3)	Agree (4)	Strongly Agree (5)
I have adequate class time for students to learn mathematics.	K-5 pre	426	3.49 (1.10)	5.6	16.9	14.3	49.3	13.8
	post	283	3.83 (1.06)	3.2	13.4	6.7	50.9	25.8
	6-8 pre	85	3.51 (1.27)	8.2	18.8	10.6	38.8	23.5
	post	71	3.61 (1.31)	4.2	26.8	7.0	28.2	33.8
	9-12 pre	46	3.13 (1.19)	6.5	30.4	19.6	30.4	13.0
	post	41	3.63 (1.18)	7.3	12.2	12.2	46.3	22.0

Table 6 reports the number of minutes mathematics is taught each week at the elementary level. A higher percentage of teachers at the elementary level (32 percent) report teaching mathematics for 241 minutes or more on the post-survey compared to about 25 percent on the pre-survey.

Table 6. Number of Minutes per Week Mathematics is Taught in Elementary School

Item	Grade Level	n	Frequency Percentages 0-60 min (1)	61-120 min (2)	121-180 min (3)	181-240 min (4)	241 or more (5)
About how many minutes of mathematics do you teach each week?	K-5 pre	425	10.1	15.3	20.7	28.5	25.4
	K-5 post	281	7.5	13.2	22.8	24.9	31.7

Assessment Practices

Tables 7, 8, and 9 show the change in frequency from pre-survey to post-survey of various assessment practices used by teachers . At both the elementary and middle levels, the number of teachers reporting that they never asked students to respond in writing to open-ended questions decreased by half from pre-survey to post-survey as shown in Table 7. High school

teachers reported an increase from pre-survey to post-survey of teachers never using open-ended questions to evaluate students. At all levels, there was an increase from pre-survey to post-survey in the number of teachers reporting that they used open-ended questions for evaluative purposes on a daily basis.

Table 7. Frequency of Selected Assessment Practices in Mathematics

Item	Grade Level	n	Frequency Percentages				
			Never (1)	Once/Twice a Semester (2)	Once/Twice a Month (3)	Weekly (4)	Almost Daily (5)
How often do you evaluate students' learning of mathematics by having them respond in writing to open-ended questions?	K-5 pre	426	32.2	18.3	22.8	20.0	6.8
	post	282	15.6	17.0	34.0	23.0	10.3
	6-8 pre	85	10.6	14.1	34.1	34.1	7.1
	post	71	5.6	19.7	28.2	32.4	14.1
	9-12 pre	46	17.4	39.1	21.7	21.7	0.0
	post	41	24.4	19.5	36.6	17.1	2.4

Table 8 reports the change in frequency from pre-survey to post-survey of evaluating students' mathematical learning with authentic performance tasks that require them to solve realistic problems and support their solutions by explaining their reasoning. Again at the elementary and middle levels, teachers were more likely to answer that they never used authentic performance tasks for evaluative purposes on the pre-survey compared to the post-survey. At the high school level, the number of teachers reporting to never use authentic performance tasks to evaluate students increased from pre-survey to post-survey. From pre-survey to post-survey, all levels reported a decrease in the number of teachers answering that they rarely use this evaluation method. All levels reported an increase from pre-survey to post-survey in the number of teachers using this evaluation method weekly.

Table 8. Assessment of Mathematics Learning through Authentic Performance Tasks

Item	Grade Level	n	Frequency Percentages				
			Never (1)	Rarely (2)	Once a month (3)	Twice a month (4)	Weekly (5)
How often do you evaluate students' mathematical learning with authentic performance tasks that require them to solve realistic problems and support their solutions by explaining their reasoning?	K-5 pre	423	10.4	22.5	19.6	20.1	27.4
	post	282	3.9	13.5	24.8	21.3	36.5
	6-8 pre	83	7.2	18.1	24.1	24.1	26.5
	post	71	2.8	8.5	15.5	35.2	38.0
	9-12 pre	45	4.4	37.8	22.2	15.6	20.0
	post	42	11.9	19.0	21.4	14.3	33.3

Table 9 shows that after two years as a MUSI school, middle school students were the most likely to be evaluated by having to prepare portfolios that included student reflection on their learning and samples of the student's work when compared to other levels.

Table 9. Assessment of Mathematics Learning through Portfolios

Item	Grade Level	n	Frequency Percentages	
			No	Yes
Do you evaluate your students' math learning by having them prepare portfolios that include student reflection on their learning and samples of student work?	K-5 pre	424	57.5	41.0
	post	283	58.0	40.6
	6-8 pre	83	36.1	60.2
	post	71	28.2	71.8
	9-12 pre	46	80.4	19.6
	post	42	76.2	23.8

Technology

The use of technology is reported in Tables 10 and 11. From pre-survey to post-survey, high school teachers reported an increased percentage (increase of 18 percentage points) of teachers that never used computers for mathematics instruction. At the elementary level, an increase from pre-survey to post-survey responses was reported, indicating that elementary level teachers used computers more frequently for mathematics instruction after the second year as a MUSI school. Computer availability is reported in Table 10. At both the middle and high school levels, teachers increasingly reported that computers were not available for math when compared to their pre-survey answers. On the pre-survey, 13 percent of middle school teachers reported that computers were not available at their school. On the post-survey, 20 percent of middle school teachers reported the same. At the high school level, only 4 percent of teachers reported a similar lack of access for mathematics instruction on the pre-survey. After two years, 14 percent of high school teachers reported that computers were not available for mathematics. However, at all levels, slight increases were reported in computer availability in the classroom. Elementary school teachers reported the greatest increase from pre-survey to post-survey in classroom access to computers (increase of 7 percent).

Table 10. Availability of Computers and Calculators for Mathematics

Item	Grade Level	n	Frequency Percentages			
			Not available for math (1)	Within the school but hard to access (2)	Within the school and easy to access (3)	Available in classroom (4)
How available are computers for mathematics instruction?	K-5 pre	423	9.0	17.0	14.7	58.2
	post	280	10.7	12.9	10.4	65.4
	6-8 pre	84	13.1	34.5	34.5	16.7
	post	69	20.2	23.2	37.7	18.8
	9-12 pre	46	4.3	41.3	52.2	0.0
	post	42	14.3	31.0	45.2	2.4
How available are calculators for mathematics instruction?	K-5 pre	421	7.8	12.4	17.3	59.6
	post	283	6.4	7.1	19.8	65.7
	6-8 pre	85	1.2	4.7	10.6	80.0
	post	71	2.8	4.2	8.5	84.5
	9-12 pre	46	2.2	13.0	30.4	52.2
	post	42	2.4	2.4	16.7	78.6

Calculators were reported to be used more frequently by elementary level students after the second year as a MUSI school than had been reported on the pre-survey as shown in Table 11. At the middle level, an increase of 8 percent of teachers reported daily use of calculators on the post-survey (almost 34 percent) compared to the number of teachers reporting the same on the pre-survey (almost 26 percent). Seventeen percent more high school teachers reported that they used calculators almost daily on the post-survey compared to the pre-survey. After the second year as a MUSI school, 71 percent of high school students had almost daily exposure to calculators during mathematics instruction. Access to calculators in the classroom increased at all levels when pre-survey and post-survey responses are compared. At the high school level, teachers reported the greatest increase from the pre-survey. Seventy-nine percent of high school teachers reported classroom availability of calculators after the second year as a MUSI school compared to 52 percent on the pre-survey.

Table 11 Frequency of Students' Use of Computers and Calculators for Mathematics

Item	Grade Level	n	Frequency Percentages				
			Never (1)	Once/Twice a Semester (2)	Once/Twice a Month (3)	Weekly (4)	Almost daily (5)
How often do students use computers for mathematics?	K-5 pre	426	12.9	6.8	22.3	40.1	17.8
	post	280	9.6	11.8	20.0	36.1	22.5
	6-8 pre	46	37.6	16.5	22.4	17.6	5.9
	post	70	34.3	22.9	22.9	14.3	5.7
	9-12 pre	46	37.0	26.1	21.7	13.0	2.2
	post	42	54.8	19.0	9.5	16.7	0.0
How often do students use calculators for mathematics?	K-5 pre	427	25.8	21.8	30.0	19.2	3.3
	post	283	18.0	25.1	31.1	21.2	4.6
	6-8 pre	46	4.7	8.2	17.6	43.5	25.9
	post	71	2.8	2.8	19.7	40.8	33.8
	9-12 pre	46	0.0	8.7	4.3	32.6	54.3
	post	42	0.0	4.8	7.1	16.7	71.4

Knowledge, Perceptions, and Beliefs

Table 12 shows the familiarity with the NCTM mathematics standards prior to becoming a MUSI school and two years later. On the pre-survey, elementary level teachers (almost 13 percent) were most likely to report not being familiar with the NCTM standards at all. After two years as a MUSI school, middle school teachers (almost 10 percent) reported the highest percentage of teachers reporting no knowledge of these mathematics standards. At both the elementary and high school levels a decrease in the number of teachers reporting no knowledge of the NCTM standards was reported on the post-survey.

At all levels, teachers were "somewhat" more familiar with the NCTM mathematics standards after two years as a MUSI school when compared to the pre-survey responses. Elementary teachers report the greatest increase in being "very" familiar with the NCTM standards when pre-survey is compared to post-survey.

Table 12. Familiarity with National Mathematics Standards

Item	Grade Level	n	Frequency Percentages			
			Not at all (1)	Heard of, but don't know much about them (2)	Somewhat (3)	Very (4)
How familiar are you with the national mathematics standards developed by the National Council of Teachers of Mathematics?	K-5 pre	423	12.8	38.5	35.5	11.1
	post	282	6.4	23.4	47.5	22.7
	6-8 pre	85	7.1	23.5	31.8	35.3
	post	71	9.9	15.5	40.8	33.8
	9-12 pre	46	6.5	10.9	43.5	39.1
	post	42	2.4	21.4	42.9	33.3

Table 13 reports teachers' perceived strengths and weakness in teaching mathematics from pre-survey to post-survey. Both the middle and high school levels reported an increase of confidence in their background content knowledge of mathematics after the second year as a MUSI school. However, high school teachers reported the greatest gain in confidence from their pre-survey response (54 percent) to their post-survey response (69 percent) to perceiving their ability in this area as "very strong."

Teachers at all levels reported an increase in their confidence to facilitate inquiry-based activities in mathematics. Elementary teachers reported an increase of nearly 14 percent more

teachers describing their ability in facilitating inquiry-based as "strong." Middle level teachers reported an increase from the pre-survey (7 percent) to the post-survey (14 percent) of seven percent for those reporting "very strong" ability. Thirty percent of high school teachers reported feeling strong or very strong in this ability on the pre-survey. Two years later, nearly 41 percent of high school teachers felt as confident about using inquiry-based activities in mathematics. However, at the high school level, the number of teachers responding on the pre-survey (15 percent) that their ability to facilitate inquiry-based activities was weak increased to about 26 percent after two years.

Teachers at the middle level reported nearly a 12 percent increase in feeling strong about their ability to use computers as an integral part of mathematics instruction after the second year of MUSI. Still, an increase (comparing the pre-survey to the post-survey) of 13 percent of teachers at this level reported perceiving their ability to use computers for mathematics instruction as "very weak." High school teachers reported a slight increase in confidence (3 percent increase in "very strong" responses on the post-survey compared to pre-survey), but for the most part, reported an increased lack of confidence in their ability to use computers for mathematics instruction. Nearly seven percent more teachers at the high school level reported on the post-survey feeling inadequate (very weak and weak) in this content area compared to the pre-survey.

Table 13. Perceived Strengths and Weaknesses in Teaching Mathematics

Item	Grade Level	n	Mean (SD)	Frequency Percentages				
				Very Weak (1)	Weak (2)	Adequate (3)	Strong (4)	Very Strong (5)
Background content knowledge of mathematics.	6-8 pre	85	3.78 (0.85)	0.0	2.4	42.4	30.6	24.7
	post	71	4.01 (0.85)	0.0	2.8	26.8	36.6	33.8
	9-12 pre	46	4.41 (0.71)	0.0	0.0	13.0	32.6	54.3
	post	42	4.60 (0.66)	0.0	0.0	9.5	21.4	69.0
Ability to facilitate inquiry-based activities in mathematics.	K-5 pre	422	3.30 (0.81)	0.2	13.7	49.1	29.4	7.6
	post	283	3.34 (0.84)	1.1	13.8	42.8	35.3	7.1
	6-8 pre	85	3.28 (0.87)	1.2	16.5	42.4	32.9	7.1
	post	71	3.39 (0.96)	2.8	11.3	43.7	28.2	14.1
	9-12 pre	46	3.15 (0.94)	4.3	15.2	50.0	21.7	8.7
	post	42	3.21 (1.05)	2.4	26.2	31.0	28.6	11.9
Ability to use computers as an integral part of mathematics instruction.	K-5 pre	421	2.94 (1.10)	9.0	25.7	37.5	17.8	10.0
	post	282	2.92 (1.09)	10.6	23.0	37.9	20.2	8.2
	6-8 pre	85	2.51 (1.26)	29.4	20.0	28.2	15.3	7.1
	post	71	3.82 (1.03)	16.9	19.7	28.2	26.8	8.5
	9-12 pre	46	2.70 (1.15)	15.2	30.4	32.6	13.0	8.7
	post	42	2.64 (1.27)	19.0	33.3	23.8	11.9	11.9
Ability to regularly integrate calculators into lessons as a learning tool.	K-5 pre	415	2.80 (1.06)	11.8	27.0	37.3	17.6	6.3
	post	283	2.81 (1.10)	12.4	26.1	37.8	15.5	8.1
	6-8 pre	83	3.57 (1.06)	3.6	10.8	32.5	31.3	21.7
	post	71	3.82 (1.03)	4.2	5.6	21.1	42.3	26.8
	9-12 pre	46	4.07 (1.00)	0.0	4.3	32.6	15.2	47.8
	post	42	4.33 (0.75)	0.0	0.0	16.7	33.3	50.0

At both middle and high school levels, an increase in teachers confidence in their ability to integrate calculators into lessons as a learning tool for students was reported on the post-survey compared to the pre-survey. Sixty-nine percent of middle level teachers reported feeling strong or very strong in this ability after the second year of MUSI compared to 53 percent on the pre-

survey. High school teachers reported a similar trend with 63 percent responding strong or very strong on the pre-survey and 83 percent after the two years as a MUSI school.

Table 14 shows items asked only on the post-survey in regards to teachers' perceived strengths and weaknesses in mathematics. More than 95 percent of teachers at all levels reported agreeing or strongly agreeing with the statement that they understand mathematics concepts to be effective in teaching mathematics. High school teachers (100 percent agreed or strongly agreed) felt the most confident in this area compared to other levels (middle level, 98 percent; elementary level, 95 percent).

When asked to respond to the question that if they try very hard, would they still not be able to teach mathematics as well as other subjects, most teachers either disagreed or strongly disagreed that this was true for them. High school teachers (69 percent) were again most likely to strongly disagree when compared to middle (48 percent) and elementary (29 percent) levels. Elementary level teachers (12 percent) reported the most likely to agree or strongly agree with this statement about their inability to teach mathematics as well as other subjects compared to middle (7 percent) and high (5 percent) school levels.

Teachers were asked to respond to the statement "I wonder if I have necessary skills to teach mathematics." Although most (more than 83 percent) teachers responded that they strongly disagreed or disagreed with this statement, high school level teachers were the most likely to disagree/strongly disagree (95 percent) compared to middle (87 percent) and elementary (83 percent) levels. Again, elementary level teachers (10 percent) were most likely to agree or strongly agree with this statement about having the necessary skills to teach mathematics compared to middle (7 percent) and high school (5 percent) levels.

Table 14. Post Survey Perceived Strengths and Weaknesses in Mathematics

Item	Grade Level	n	Mean (SD)	Frequency Percentages				
				Strongly Disagree (1)	Disagree (2)	Undecided (3)	Agree (4)	Strongly Agree (5)
I understand mathematics concepts to be effective in teaching mathematics.	K-5	282	4.39 (0.67)	0.4	1.4	3.9	47.2	47.2
	6-8	71	4.61 (0.60)	0.0	1.4	1.4	32.4	64.8
	9-12	41	4.90 (0.30)	0.0	0.0	0.0	9.8	90.2
Even if I try very hard, I do not teach mathematics as well as other subjects.	K-5	281	2.03 (0.97)	28.5	54.1	5.7	9.3	2.5
	6-8	69	1.75 (0.96)	47.8	39.1	5.8	4.3	2.9
	9-12	39	1.54 (0.97)	69.2	15.4	10.3	2.6	2.6
I wonder if I have necessary skills to teach mathematics.	K-5	282	1.97 (0.92)	31.2	51.8	7.4	8.2	1.4
	6-8	71	1.80 (0.89)	40.8	46.5	5.6	5.6	1.4
	9-12	41	1.41 (0.84)	70.7	24.4	0.0	2.4	2.4

Table 15 shows the change in specific beliefs about mathematics. After two years as part of MUSI, teachers at all levels reported change in how they viewed students learning the best in classes of students with similar abilities. Elementary teachers changed their view the most on this specific item. On the pre-survey, 43 percent of elementary teachers reported strongly disagreeing or disagreeing with this statement. After two years in the MUSI project, nearly 60 percent of elementary teachers reported disagreeing that students learn best with other students of similar ability, an increase of 17 percent from the pre-survey. Middle (8 percent) and high school (4 percent) level teachers also reported increases from pre-survey to post-survey, but not to the same magnitude as elementary level teachers. High school teachers (60 percent) continued to be the most likely to agree/strongly agree with this statement after two years of MUSI when compared with teachers at other levels (middle level, 30 percent; elementary, 19 percent).

Teachers were asked whether they agreed with the statement that students need to master computation before going on to algebra. From pre-survey to post-survey, changes were noted with middle and high school teachers; however, elementary teachers reported little change in their belief about this statement. The change in the percentage of middle and high school teachers reporting that they strongly disagreed that students must master computation prior to algebra was about 6 percent for both levels comparing pre-survey to post-survey responses.

Emphasizing broad coverage of many mathematical ideas was seen as less important by teachers at all levels after the two years in the MUSI project compared to the pre-survey responses. Teachers at the high school level (increase of 20 percent) reported the most change among teachers responding that they disagreed/strongly disagreed compared to middle (10 percent increase) and elementary (3 percent) levels. Elementary teachers were the most likely to agree/strongly agree with this belief in both the pre-survey and post-survey.

Table 15. Beliefs about Mathematics

Item	Grade Level	n	Mean (SD)	Frequency Percentages				
				Strongly Disagree (1)	Disagree (2)	Neutral (3)	Agree (4)	Strongly Agree (5)
Students learn best in classes of students with similar abilities.	K-5 pre	426	2.91 (1.18)	10.8	32.2	22.5	24.4	10.1
	post	283	2.54 (1.04)	11.3	48.4	20.8	14.1	5.3
	6-8 pre	84	3.27 (1.18)	3.6	28.6	23.8	25.0	19.0
	post	70	2.89 (1.12)	10.0	30.0	30.0	21.4	8.6
	9-12 pre	46	3.93 (0.98)	0.0	8.7	23.9	32.6	34.8
	post	40	3.75 (1.01)	0.0	12.5	27.5	32.5	27.5
Students need to master computation before going on to algebra.	K-5 pre	425	3.61 (1.13)	4.7	13.4	22.1	36.0	23.8
	post	281	3.64 (1.12)	2.5	16.4	22.1	32.4	26.7
	6-8 pre	85	3.44 (1.35)	7.1	25.9	14.1	22.4	30.6
	post	71	3.66 (1.19)	1.4	23.9	12.7	31.0	31.0
	9-12 pre	46	3.76 (1.39)	6.5	19.6	10.9	17.4	45.7
	post	41	4.15 (1.09)	0.0	14.6	7.3	26.8	51.2
It is important to emphasize broad coverage of many mathematical ideas.	K-5 pre	424	3.78 (0.90)	3.1	5.0	20.3	54.2	17.5
	post	283	3.86 (0.92)	1.4	9.2	14.5	51.9	23.0
	6-8 pre	85	3.66 (0.95)	1.2	11.8	24.7	44.7	17.6
	post	71	3.48 (1.04)	1.4	21.1	21.1	40.8	15.5
	9-12 pre	46	3.80 (0.88)	0.0	6.5	30.4	39.1	23.9
	post	41	3.37 (1.11)	2.4	24.4	24.4	31.7	17.1

Student Expectations and Policy

Table 16 reports the change in teachers' expectations that students in the teacher's current class can learn to think and work mathematically to high levels. Teachers at all levels, especially elementary, indicated more students could think at high levels. However, substantial numbers of teachers at all levels indicated that few students in their current classes were capable of such high levels of work. High school teachers were most likely to respond that none or few of their students could think mathematically to high levels on both the pre-survey and the post-survey.

In February 1996, the MPS School Board adopted a new graduation policy for mathematics. It was effective for the graduating class of 2004. Table 16 reveals the changes in expectations among teachers after participating in MUSI regarding whether students will be able to meet the new MPS policy. Small changes on the post-survey in the frequencies were reported, however, none were substantial alterations from the pre-survey responses. Most changes were no greater than three or four percent from pre-survey to post-survey.

Table 16. Expectations of Students Ability to Achieve in Mathematics

Item	Grade Level	n	Mean (SD)	Frequency Percentages None (1)	Few (2)	Some (3)	Most (4)	All (5)
Based upon your current class of students, how many students can learn to think and work mathematically to high levels?	K-5 pre	424	2.99 (0.99)	5.4	25.7	40.6	20.8	7.5
	post	282	3.41 (0.82)	1.1	11.3	40.1	40.8	6.7
	6-8 pre	84	3.23 (1.00)	2.4	22.6	35.7	28.6	10.7
	post	70	3.31 (0.86)	1.4	14.3	42.9	34.3	7.1
	9-12 pre	46	3.02 (1.00)	2.2	34.8	28.3	28.3	6.5
	post	42	3.05 (0.79)	0.0	28.6	38.1	33.3	0.0
How many students will be able to achieve the new School Board Policy: Students will demonstrate three years of study beyond Algebra One. Students will be expected to show proficiency in first year algebra by the end of the eighth grade.	K-5 pre	415	3.21 (0.66)	0.7	9.9	58.6	29.4	1.4
	post	280	3.31 (0.67)	0.4	6.8	57.9	31.4	3.6
	6-8 pre	80	3.20 (0.75)	1.3	12.5	55.0	27.5	3.8
	post	68	3.15 (0.72)	1.5	14.7	51.5	32.4	0.0
	9-12 pre	45	2.64 (0.68)	2.2	40.0	48.9	8.7	0.0
	post	42	2.74 (0.73)	2.4	35.7	47.6	14.3	0.0

Table 17 shows the frequency at which teachers responded to queries about student expectations on the post-survey. Teachers at the high school level (83 percent) were most likely to strongly disagree or disagree that underachieving students in mathematics is most likely due to ineffective teaching compared to middle (65 percent) and elementary (49 percent) levels. Elementary teachers were the most likely to agree with this statement about underachieving students resulting from ineffective teaching.

Teachers were asked to report their level of agreement with the statement that increased effort in mathematics teaching produces little change. High school teachers (59 percent) were the most likely to agree or strongly agree with this statement. Middle level (65 percent) and elementary level (62 percent) teachers were more likely to disagree or strongly disagree.

The inadequacy of a student's mathematics background was most likely to be viewed as able to be overcome by good teaching by both elementary (64 percent) and middle level (64 percent) teachers compared to high school (33 percent) level. Interestingly, 34 percent of high school teachers disagreed/strongly disagreed with this statement and were most likely to view mathematics background as something that even good teaching could not overcome.

Table 17. Post Survey Opinions and Expectations of Students Ability in Mathematics

Item	Grade Level	n	Mean (SD)	Frequency Percentages Strongly Disagree (1)	Disagree (2)	Undecided (3)	Agree (4)	Strongly Agree (5)
Underachieving students in mathematics is most likely due to ineffective teaching.	K-5	283	2.67 (1.07)	12.7	36.7	24.7	22.3	3.5
	6-8	71	2.25 (0.94)	21.1	43.7	25.4	8.5	1.4
	9-12	41	2.02 (0.85)	24.4	58.5	7.3	9.8	0.0
Increased effort in mathematics teaching produces little change.	K-5	282	2.50 (0.97)	10.3	52.1	16.7	19.1	1.8
	6-8	71	2.45 (1.01)	14.1	50.7	11.3	23.9	0.0
	9-12	41	3.34 (1.22)	7.3	24.4	9.8	43.9	14.6
The inadequacy of a student's mathematics background can be overcome by good teaching.	K-5	281	3.65 (0.85)	0.4	10.7	25.3	50.5	13.2
	6-8	70	3.63 (0.97)	1.4	14.3	20.0	48.6	15.7
	9-12	40	3.03 (1.03)	5.0	27.5	35.0	25.0	7.5

In February 1996, the MPS School Board adopted a new graduation policy for mathematics. It was effective for the graduating class of 2004. Table 18 reports the pre-survey and post-survey

frequencies of teacher support for the new policy. From pre-survey to post-survey, very little change was indicated by teachers at all levels in the level of support for the new MPS School Board policy for mathematics. High school teachers remain the least likely to express support for the new graduation policy.

Table 18. Level of Support for New School Board Policy in Mathematics

Item	Grade Level	n	Mean (SD)	Frequency Percentages				
				Strongly Opposed (1)	Oppose (2)	Neutral (3)	Strong (4)	Very Strong (5)
Indicate your level of support for the new School Board policy for mathematics.	K-5 pre	420	3.42 (0.91)	2.6	9.8	41.4	35.0	11.2
	post	279	3.41 (0.88)	1.8	11.5	40.9	36.2	9.7
	6-8 pre	80	3.41 (1.06)	3.8	15.0	35.0	28.8	17.5
	post	64	3.42 (1.07)	7.8	6.3	35.9	35.9	14.1
	9-12 pre	45	2.42 (1.20)	24.4	35.6	20.0	13.3	6.7
	post	41	2.29 (1.17)	31.7	26.8	26.8	9.8	4.9

Professional Development and Collaboration

Teachers were asked to indicate their level of agreement with the statements about peer collaboration and support in mathematics shown in Table 19. At the middle level (56 percent on post-survey), teachers reported a greater feeling of being supported by colleagues to try out new ideas in teaching mathematics after the two years of MUSI than on the pre-survey (34 percent). At both the elementary level (22 percent, pre-survey; 37 percent, post-survey) and high school level (48 percent, pre-survey; 56 percent, post-survey) smaller increases in teachers feeling supported by colleagues were reported.

At the middle level, teachers increased the frequency with which they disagreed/strongly disagreed with the statement that ideas and materials were regularly shared amongst teachers in a school. Elementary level teachers increased in their support of this statement, from 45 percent on the pre-survey to 59 percent on the post-survey two years later.

About 21 percent of middle level teachers on the pre-survey reported disagreeing or strongly disagreeing that ideas were shared regularly. After two years as a MUSI school, 28 percent of teachers reported disagreeing. Few changes were seen at the high school level.

Teachers at the elementary level increased their agreement with the statement that there are opportunities to learn new things about teaching mathematics in their present job by about 14 percent from pre-survey responses to post-survey. Fifteen percent of the total 22 percent of teachers at the middle level that reported being neutral to this statement on the pre-survey apparently changing their view after two years in a MUSI school. Middle level teachers increased their support of this view by about 15 percent from pre-survey to post-survey. From pre-survey to post-survey, fewer high school teachers reported disagreeing that there were opportunities to learn new things about teaching mathematics and increased in their agreement with that statement.

Overall, the largest change from pre-survey to post-survey in the frequency of responses to the statement that teachers have been involved in specific efforts to narrow achievement gaps in mathematics between ethnic, gender, and income groups was at the high school level. Teachers at that level increased in their strongly agreeing by about 16 percent on the post-survey (22 percent) compared to the number of teachers agreeing on the pre-survey (nearly 6 percent). Middle level and elementary level teachers increased by 10 percent in the number disagreeing

that they have been involved with narrowing achievement gaps after two years in the MUSI project.

Table 19. Peer Collaboration and Support in Mathematics

Item	Grade Level	n	Mean (SD)	Frequency Percentages				
				Strongly Disagree (1)	Disagree (2)	Neutral (3)	Agree (4)	Strongly Agree (5)
I feel supported by my colleagues to try out new ideas in teaching mathematics.	K-5 pre	427	3.76 (0.98)	3.7	6.1	22.7	45.7	21.8
	post	283	4.07 (0.95)	1.8	6.7	11.0	43.8	36.7
	6-8 pre	85	3.85 (1.23)	8.2	5.9	15.3	34.1	36.5
	post	71	4.23 (0.74)	1.4	1.4	5.6	56.3	35.2
	9-12 pre	46	3.91 (0.91)	2.2	4.3	19.6	47.8	26.1
	post	41	4.10 (0.80)	2.4	0.0	12.2	56.1	29.3
Teachers in this school regularly share ideas and materials about mathematics.	K-5 pre	427	3.21 (1.08)	7.0	19.7	27.9	36.3	9.1
	post	282	3.39 (1.15)	5.7	22.7	12.8	45.0	13.8
	6-8 pre	85	3.58 (1.12)	3.5	17.6	17.6	40.0	21.2
	post	71	3.42 (1.19)	7.0	21.1	9.9	46.5	15.5
	9-12 pre	46	3.83 (1.04)	2.2	13.0	10.9	47.8	26.1
	post	41	3.85 (1.01)	2.4	12.2	7.3	53.7	24.4
I feel that I have many opportunities to learn new things about teaching mathematics in my present job.	K-5 pre	427	3.30 (1.07)	6.8	18.3	20.8	46.6	7.5
	post	282	3.62 (1.09)	2.5	20.2	9.9	47.2	20.2
	6-8 pre	85	3.80 (1.14)	7.1	12.9	22.4	37.6	20.0
	post	71	3.72 (1.19)	7.0	12.7	7.0	47.9	25.4
	9-12 pre	46	3.13 (1.19)	10.9	10.9	8.7	60.9	8.7
	post	41	3.83 (1.00)	4.9	4.9	14.6	53.7	22.0
I have been involved in specific efforts to narrow achievement gaps in mathematics between ethnic, gender, and income groups.	K-5 pre	424	3.18 (1.09)	7.3	10.1	16.0	50.4	16.2
	post	280	3.41 (1.15)	5.4	22.1	13.2	44.3	15.0
	6-8 pre	85	3.51 (1.16)	7.1	12.9	22.4	37.6	20.0
	post	71	3.37 (1.26)	9.9	19.7	11.3	42.3	16.9
	9-12 pre	46	3.26 (1.06)	6.5	19.6	21.7	45.7	6.5
	post	41	3.46 (1.27)	9.8	14.6	17.1	36.6	22.0

Table 20 reports the post survey perceptions of whether the MSRTs and MUSI helped to improve mathematics instruction and a school's mathematics program. Middle level teachers (64 percent) were the most likely to agree or strongly agree that the MSRT at their school had assisted them in improving mathematics instruction compared to elementary level (41 percent) and high school level (33 percent). A large percentage of elementary level (46 percent) and high school (40 percent) disagreed or strongly disagreed that the MSRT had assisted them compared to 19 percent of middle level teachers.

Table 20. Post Survey Perception of MUSI Project's Effect in Mathematics At the School Level

Item	Grade Level	n	Mean (SD)	Frequency Percentages				
				Strongly Disagree (1)	Disagree (2)	Undecided (3)	Agree (4)	Strongly Agree (5)
The MSRT at my school has assisted me in improving my mathematics instruction.	K-5	281	2.81 (1.41)	25.6	21.0	12.5	28.8	12.1
	6-8	70	3.54 (1.07)	5.7	12.9	17.1	50.0	14.3
	9-12	40	2.83 (1.28)	20.0	20.0	27.5	22.5	10.0
Being a MUSI school has allowed us to improve our mathematics program.	K-5	283	3.06 (1.29)	17.7	14.1	26.1	29.0	13.1
	6-8	71	3.63 (0.78)	0.0	4.2	42.3	39.4	14.1
	9-12	40	3.10 (1.08)	10.0	15.0	37.5	30.0	7.5

Teachers were asked to report whether they agreed or disagreed that being a MUSI school has allowed them to improve the mathematics program at their school. Middle level (54 percent) teachers were the most likely to agree or strongly agree that being a part of MUSI has improved their mathematics program compared to elementary level (42 percent) and high school level (38 percent). However, nearly 32 percent of elementary level teachers and 25 percent of high school teachers reported disagreement with that statement.

Table 21 reports the number of hours of professional development in mathematics that teachers at all levels received. Pre-survey responses are indicated for the years of 1995 to 1996 while post-survey responses are indicated for 1996 to 1997 and 1997 to 1998 separately. At the elementary level, more teachers were likely to report 1 to 5 hours of training for all three years. However, about 10 percent fewer teachers on the pre-survey reported 1 to 5 hours for 1995 to 1996 compared to the post-survey years of 1996 to 1998. An increase in the number of elementary teachers reporting 6 to 15 hours of professional development was reported on the post-survey compared to the pre-survey. From pre-survey to post-survey years, middle level teachers reported a consistent increase in the numbers of teachers reporting 1-5 hours and 6-15 hours of professional development and a yearly decrease in the number of teachers reporting both 16-35 hours and 36 or more hours of professional training. For high school teachers, frequencies change sporadically from year to year with few consistent trends. In 1995-1996, high school teachers were most likely to report receiving 6-15 hours of training. In 1996-1997, 36 or more hours was reported as the most likely number of hours of professional training for high school teachers. In 1997-1998, most high school teachers reported receiving between 6 and 35 hours of training.

Table 21. Number of Hours of Professional Development in Mathematics

Item	Grade Level	n	Frequency Percentages				
			0 hours (1)	1-5 hours (2)	6-15 hours (3)	16-35 hours (4)	36 + hours (5)
From Sept. 1995 to Aug. 1996, what	K-5 '95-96	419	22.9	45.6	16.2	10.0	5.3
is the total amount of time you spent	'96-97	279	23.3	36.9	25.4	7.2	7.2
on staff development in	'97-98	276	18.8	33.0	25.4	13.0	9.8
mathematics?	6-8 '95-96	79	15.2	19.0	12.7	25.3	27.8
(Post data includes time spent on	'96-97	71	18.3	21.1	16.9	19.7	23.9
staff development from Sept. 1996	'97-98	70	8.6	27.1	30.0	12.9	21.4
through August 1997, and Sept. 1997	9-12 '95-96	46	13.0	13.0	30.4	15.2	28.3
through August 1998).	'96-97	40	10.0	20.0	25.0	12.5	32.5
	'97-98	41	17.1	9.8	29.3	26.8	17.1

Impact of MUSI on Mathematics Instruction

Teachers at all levels were asked to respond to the open-ended question "What is the biggest impact MUSI has had on your mathematics instruction?" The responses were categorized by emergent themes at each level. The list of categories with frequency and the percent of teachers responding in each category are given for each level. Some of the prevalent themes are also summarized with representative teacher responses.

Elementary School MUSI Impact

A total of 173 elementary teachers gave 195 responses. Table 22 identifies the categories identified, as well as the frequency and the percent of teachers responding in each category. Overall, 61 percent or 119 responses indicated a positive impact of MUSI on their mathematics

instruction. The other 39 percent or 76 responses indicated reported that MUSI made little or no impact or that they were unfamiliar with the initiative.

Table 22. Impact of MUSI on Mathematics as Reported by Elementary Teachers

Impact	Frequency	Percentage
Improvements in Instructional Methods	33	16.9%
Improved Access to Materials/Supplies	19	9.7%
Generation of Ideas/Suggestions	19	9.7%
MSRT as Mentor/Support	18	9.2%
Access to UWM Classes	15	7.7%
Awareness of Higher Standards	6	3.1%
Miscellaneous Impact of MUSI	8	4.1%
Little/No Impact Resulting from MUSI	72	36.9%
Unfamiliar with MUSI/Unsure	4	2.0%

Improvements in Instructional Methods. Teachers' responses indicated that the impact MUSI had over the two years included a broad range of improvements and supports to the instructional style and methods of teachers. Several key concepts and themes were the added resources available to teachers, changes in the method of inquiry by teachers of their students, and the utilization of new concepts or processes during instruction.

- MUSI has helped me feel more comfortable teaching with manipulatives. Helped me teach concepts with new methods and approaches. Encouraged me to have students work cooperatively.
- It has helped me to understand the need for children to develop a true sense and understanding of numbers. It has also shown me ways to develop this. I now ask my students for explanations and pull from them those deep thinking answers. I also wait for them to discover their answers.
- Types of questions I ask students while teaching to assess learning. Helped ask better questions so that children get more involved and better understanding of concepts.
- Helped me to change my focus from strict computation to a more developmentally appropriate inquiry based instruction with a focus on student understanding.
- I have been able to push children to higher levels of learning. Able to expose them to thinking mathematically in daily activities.
- MUSI has helped me feel more comfortable teaching with manipulatives. Helped me teach concepts with new methods and approaches. Encouraged me to have students work cooperatively.

Improved Access to Materials and Supplies. In relation to materials and supplies, teachers' responded with several similar improvements due to MUSI: increased access to materials, increased knowledge in using materials for instruction, and especially an increased availability to manipulatives.

- Introduction to the use of manipulatives into the classroom .
- Took my ideas about materials and helped to expand them.
- The biggest impact MUSI has had on my math teaching has been in providing readily available consumable and nonconsumable materials.
- Calculators are more integrated in instruction.
- It has supplied support and materials for my mathematics instruction.

Generation of Ideas and Suggestions. Teachers reported many different areas in which MUSI impacted their ideas and receiving of suggestions in relation to mathematics instruction. The main themes were concentrated in two areas: new ideas and support for sharing ideas.

- It provided new approaches to teaching math concepts.
- Provided me with a wide range of ideas as well as exposure to other educator's views on the teaching of mathematics.
- The enthusiasm, brainstorming, and staff development lessons were also very useful.
- Excellent ideas to new approaches to problem-solving. Also new ways to remove anxiety from math.
- Opening up new concepts and methods for teaching math and in providing ideas on specific math topics.

MSRT as Mentor and Support. Nearly 10 percent of responses indicated that the MSRT provided an abundance of support and training for the mathematics teachers. Several main areas in which teachers reported receiving a benefit from the MUSI Math/Science Resource Teacher were development of the teacher's understanding and skills, modeling effective curriculum instruction, and providing unity of vision.

- Our MSRT has helped us align our teaching to assessment, provided for an evening activity for parents, and helped us to increase and focus on our math teaching.
- MSRT supported the entire staff to work toward the same vision in math and science. Together we learned what effective math/science lessons look like and how to align our curriculum.
- Through MUSI, the MSRT brought CGI to our school. As a K-4 teacher, with a half-day program, time is not readily available; however, the problem solving nature of CGI and the many math oriented activities we are already doing is providing a deeper understanding of mathematical concepts. The MSRT has helped me be a better teacher.
- MUSI has been a valuable resource to my math curriculum. My MSRT has effectively modeled authentic performance tasks and critical thinking procedures to better develop concepts.
- We engaged in team teaching to help all students.

Access to UWM Classes. Some teachers reported that access to UWM classes and the instruction obtained from those courses was the greatest area in which MUSI impacted their performance. For many teachers, this was an opportunity to increase their knowledge and expose themselves to new concepts and ideas.

- I took a MUSI-UWM course last summer which updated me on NCTM standards.
- I took a math class in which I have learned a great deal. I have put many of the ideas presented in my MUSI-UWM class to good use in my kindergarten class.
- Because of MUSI, I was able to take two UWM math classes that I probably wouldn't have taken. These classes changed my style and outlook toward teaching math dramatically.
- I changed methods and attitudes for teaching math through UWM course.
- UWM classes provided me with ideas to expand math beyond what I've tried before.

Little to No Impact Resulting from MUSI. Many teachers responded that MUSI had little or no impact on themselves or schools. Themes which emerged from the responses indicating little to no impact included a lack of access to the MSRT, comparisons between MUSI's impact and the impact of another pilot project, disagreement about the use of funds for MUSI, and no application of MUSI within the teacher's instructional method.

- None. We've implemented a new math program this year and the MSRT has not offered any help. She also has never come to my room to work with any students.
- None. The only impact that would be meaningful to a successful program is lower class size. $15 million could have been spent in a much better way—new buildings, more classrooms, more teachers.
- Our assigned MUSI teacher is woefully inadequate. This person has had, if anything, a negative impact on my math efforts. The MSRT has provided no help at all despite repeated requests.
- In the two years the MUSI teacher has been at our school, the person has never worked or met with the Kindergarten unit even after being asked and invited. Other staff members have been of more assistance to me.
- Zero impact, unless you consider anger and frustration at having a highly paid professional in the building who did nothing. If this is what we get for our money, we should save it or spend it on something else.

Middle School MUSI Impact

Forty-five middle school mathematics teachers gave 79 responses. Table 23 identifies themes into which the responses were categorized with the frequency and the percent of teachers responding in each category. Overall, 86 percent or 68 responses indicated a positive impact of MUSI on their mathematics instruction. The other 14 percent or 11 responses indicated that MUSI made little or no impact or that they were unfamiliar with the initiative.

Table 23. Impact of MUSI on Mathematics as Reported by Middle School Teachers

Impact	Frequency	Percentage
MSRT as Mentor/Support	16	20.3%
Improvements in Instructional Method	13	16.5%
Improved Access to Materials/Supplies	9	11.4%
Increased Understanding of Proficiency 2000	8	10.0%
Generation of Ideas	5	6.3%
Access to UWM Classes	4	5.1%
Feeling More Comfortable/Supported	4	5.1%
Increased Staff Development	4	5.1%
Awareness of CMP	3	3.8%
Miscellaneous Impact of MUSI	2	2.5%
Little/No Impact Resulting from MUSI	8	10.1%
No Comment/Unsure of Impact	3	3.8%

MSRT as Mentor or Support. Teachers reported MUSI impacting them due to the MSRT being available as a support and resource person. Themes emerged from the teachers' responses which included the MSRT as an additional support, having current resources available through the MSRT, and that the MSRT was a model for effective instruction.

- The MSRT was a spokesperson who we could go to for advice. Also, math teachers who have not been inserviced (myself) this past year on the Algebra project and Equity 2000 had a place to turn to for information.
- The MSRT had constant contact with all of us, keeping us current on latest math ideas. A very resourceful person who cares about our math program and students.
- Training on the implementation of the use of technology and manipulatives in the teaching of mathematics was received.
- Training in how to use graphing calculators with students was valuable.
- The MSRT helped in simplifying concepts and assisted in planning.

Improvement in Instructional Methods. Middle level teachers responding to the open-ended questions reported some impact of instructional style or method. Themes emerging from these responses included teachers learning new methods, improvement in low skill areas, and support to continue improving as an instructor.

- It causes me to teach practical problem-solving methods. It causes me to look for new ways to help children understand the lessons.
- I feel the biggest impact MUSI has had is the various styles one can use to help students achieve in math.
- MUSI gives continued support in doing new things in math. Support and help in trying things I may need to learn about.
- MUSI has continued the emphasis being placed on the concept of incorporating more hands on activities of students. The ability and opportunity for students to collaborate and work cooperatively. Students also being required to communicate their solutions and strategies they used to arrive at those solutions. The emphasis of the learning to become student centered.

Improved Access to Materials and Supplies. Teachers reported that MUSI impacted them as a direct result of having access to materials, and support in finding information and materials if not directly available in the school.

- MUSI provided access to resources.
- MUSI has provided me with manipulatives for my classes.
- Helped in finding more resources to support inquiry based learning.
- MUSI helped in getting me curriculum guides.

Increased Understanding of Proficiency 2000. Middle school teachers reported MUSI's impact in their increased understanding of the Proficiency 2000 standards and how they can best help students meet those standards.

- It has also provided direction in the proficiency 2000 project.
- MUSI is helping to access and define MPS proficiencies and assessments.
- MUSI has brought an intense focus to the issues of math and science proficiency.
- Made sure that students are prepared to meet the math proficiency requirements.

Little or No Impact Resulting from MUSI. Several middle school teachers reported little or no impact related to the MUSI project. Emergent themes among the teachers' responses included not being impacted personally, not having access to the MSRT, and no apparent changes in outdated equipment.

- There has been little impact on my math instruction due to emphasis in science.
- MUSI has not impacted me personally, but I realize that it has in some other classes.
- Math is being looked at but I still don't think hard enough, because our math lab is only for a few. It (the lab) has old apple IIe's. Math classes have no access to it.
- MUSI has not had much influence in our math department at our school. I feel we have a very strong math department and help is not always needed.
- Most efforts were targeted at the newer teachers in our unit.
- I have no idea what MUSI is or what it does.

High School MUSI Impact

Twenty-nine mathematics teachers gave 48 responses. Table 24 identifies the responses given and the frequency and the percent of teachers responding in each category. Overall, 71 percent or 34 responses indicated a positive impact of MUSI on their mathematics instruction. The other 29 percent or 14 responses indicated that MUSI made little or no impact or that they were unfamiliar with the initiative.

Table 24. Impact of MUSI on Mathematics as Reported by High School Teachers

Impact	Frequency	Percentage
MSRT as Mentor/Support	9	18.8%
Generation of Ideas for Activities	6	12.5%
Improvements in Instructional Method	4	8.3%
Improved Access to Materials/Supplies	4	8.3%
Improved Proficiency Surveying	3	6.3%
Assistance in Using Technology	3	6.3%
Improved Inservices/Workshops	2	4.2%
Miscellaneous Impact of MUSI	3	6.3%
Little/No Impact Resulting from MUSI	11	22.9%
Unsure of Impact	3	6.3%

MSRT as Mentor and Support. Teacher's responses indicated that after two years in the MUSI project, the most impact was a result of interactions with the MSRTs. MSRTs were reported to have provided practical assistance with graphing calculators, assistance with proficiency surveying, and acting as a liaison between mathematics and science.

- The MSRT has assisted in proficiency surveying and working with students in proficiency classes. MSRT has performed as a coordinator or liaison between math and science instruction.
- The assistance from our MSRT has had the biggest impact on my instruction.
- The MUSI teacher assisted with lessons relating to graphing calculators and collecting data.
- Sometimes you need extra time to get materials together to try new things. The MSRT not only can use their time to help get the materials together they can also help you implement this and make it a better experience.

Generation of Ideas for Activities. High school teachers indicated that after two years in the MUSI project, additional ideas for projects and field trips was gained. Further, MUSI provided the needed assistance for fresh ideas for classroom presentations and other curriculum instruction.

- Getting ideas on presentations has helped me in examining what I thought I was teaching.
- I was given many ideas for hands-on inquiry based activities.
- There was much support given for projects within the 9th grade for families and field trips.

Improvement in Instructional Method. Teachers in the high schools reported some impact on instructional style and method. The overall theme with MUSI's impact on instruction included increased confidence and a shift away from traditional teaching methods.

- I believe my instruction has improved because of the assistance.
- I have been more comfortable in trying new approaches in math instruction.
- MUSI has changed my teaching from traditional to more active learning.

Improved Access to Materials and Resources. Some high school teachers indicated a change or impact related to materials and resources.

- The money has been available for needed materials which held me back before.
- Having access to additional resources from other places has helped.
- Sometimes you need extra time to get materials together to try new things. The resource teacher not only can use her time to help get the materials together they can also help you implement this and make it a better experience.

Little or No Impact Resulting from MUSI. Nearly one-fourth of the responses indicated that MUSI had little or no impact on teachers or within the schools.

- None. You can get as much support as you desire.
- MUSI has had no impact on my instruction.
- MUSI has had little or no direct impact on my math instruction.

Science Results

This section contains the results of the scaled-responses from the elementary, middle, and high school surveys in science and the results of the open-ended item regarding the impact of MUSI on science instruction. Frequencies are given for each of the scaled-response items by level, and where appropriate, the means are reported. The categories that emerged from the open-ended responses are given for each level.

Instructional Practices, Supplies, and Time

Teachers were asked to report on the frequency that the instructional practices listed in Table 25 occurred in their teaching of science. Responses for both the pre-survey and the post-survey are reported. Elementary teachers were more likely to report using student-generated experiments with outcomes unknown to them once/twice a month on the post-survey (40 percent) compared to the pre-survey (28 percent). Fewer elementary teachers reported never using student-generated experiments on the post-survey (11 percent) compared to the pre-survey (27 percent). Middle level teachers reported a similar decrease in the number of teachers reporting never using this instructional method from pre-survey (13 percent) to post-survey (2 percent). Student-generated experiments were most likely to be used once/twice a month by middle level teachers after two years in the MUSI project (40 percent on the post-survey) compared to the pre-survey (26 percent). At the high school level, a 12 percent decrease was reported in the number of teachers reporting never to use student-generated experiments from pre-survey to post-survey. Most high school teachers (52 percent) reported using this instructional method once/twice a semester on the post-survey compared to the pre-survey (27 percent). A substantial increase in the number of high school teachers reporting weekly use of student-generated experiments was recorded on the post-survey (15 percent) compared to the pre-survey (3 percent).

Table 25. Frequency of Instructional Practices in Science

Item	Grade Level	n	Frequency Percentages				
			Never (1)	Once/Twice a Semester (2)	Once/Twice a Month (3)	Weekly (4)	Almost Daily (5)
Students conduct student-generated experiments with outcomes unknown to them and in which students control variables.	K-5 pre	420	26.9	24.5	27.6	18.6	2.4
	post	272	11.4	23.2	40.1	23.2	2.2
	6-8 pre	77	13.0	41.6	26.0	15.6	3.9
	post	63	1.6	39.7	39.7	15.9	3.2
	9-12 pre	30	33.3	26.7	26.7	3.3	0.0
	post	27	11.1	51.9	22.2	14.8	0.0
Students perform demonstrations with materials by following a prescribed set of procedures in order to observe a scientific phenomenon.	K-5 pre	420	15.7	23.8	37.1	21.2	2.1
	post	274	8.0	20.1	44.2	26.3	1.5
	6-8 pre	77	3.9	18.2	48.1	23.4	6.5
	post	63	1.6	10.9	46.0	27.0	6.3
	9-12 pre	31	9.7	6.5	32.3	45.2	6.5
	post	27	7.4	3.7	40.7	44.4	3.7

Students performed demonstrations with materials by following a prescribed set of procedures in order to observe a scientific phenomenon in similar frequencies on the pre-survey and post-survey. Slight changes were seen at the elementary level where 8 percent fewer teachers reported never using student performed demonstrations from the pre-survey to the post-survey.

Students at all levels were most likely to perform demonstrations once/twice a month or weekly after two years as a MUSI school.

As shown in Table 26, elementary teachers were asked to report on the post-survey their utilization of the MPS Science Kit and Guide. Most elementary teachers reported using the MPS Science Kits (63 percent), availability of supplies to do hands-on science (68 percent), and utilizing the MPS Science Content Standards and Process Outcomes Guide (62 percent). However, 20 percent of elementary teachers disagreed with those statements about using the MPS Science Kit and Guide as part of their science program.

Table 26. Post-Survey Frequency of Utilization of Elementary MPS Science Kits and Guide

Item	Grade Level	n	Mean (SD)	Frequency Percentages				
				Strongly Disagree (1)	Disagree (2)	Undecided (3)	Agree (4)	Strongly Agree (5)
The MPS Science Kits are an essential part of my science program.	K-5	278	3.69 (1.20)	4.7	15.8	16.2	32.4	30.9
I am able to get necessary supplies at my school to do hands-on science with the MPS science kits.	K-5	279	3.70 (1.12)	4.7	13.6	13.3	44.4	24.0
I utilize the MPS Science Content Standards and Process Outcomes guide.	K-5	277	3.57 (1.06)	3.2	16.6	18.1	44.4	17.7

Table 27 shows teacher utilization of the Science Curriculum Guide. Middle level teachers (33 percent) were most likely to report using the Science Curriculum Guide all of the time compared to high school teachers (19 percent). However, teachers at both middle (49 percent) and high school (48 percent) reported using it occasionally.

Table 27. Post-Survey Utilization of Science Curriculum Guide for Middle and High School

Item	Grade Level	n	Frequency Percentages			
			Not Applicable (1)	Not At All (2)	Sometime (3)	All the Time (4)
I utilize the Middle Level Science. Integrated Ninth Grade Science, or Biology Curriculum Guide developed by MPS in planning and implementing my science program.						
	6-8	63	1.6	15.9	49.2	33.3
	9-12	27	18.5	14.8	48.1	18.5

As shown in Table 28, informal learning environments were generally used 1-2 times on both the pre-survey and post-survey. Fewer middle (6 percent) and high school level (0 percent) teachers reported on the post-survey using informal learning environments 6 or more times per year compared to the pre-survey (12 percent, middle; 6 percent, high school).

Table 28. Use of Informal Learning Environments for Science in 1995-96

Item	Grade Level	n	Frequency Percentages				
			Never (1)	1-2 times (2)	3-5 times (3)	6-8 times (4)	9 or more (5)
Students visited informal learning environments as part of the science program.	K-5 pre	413	8.7	49.4	34.4	5.6	1.9
	post	275	8.0	48.7	33.8	7.3	2.2
	6-8 pre	74	17.6	39.2	31.1	8.1	4.1
	post	63	17.5	57.1	19.0	6.3	0.0
	9-12 pre	31	45.2	32.3	16.1	3.2	3.2
	post	27	37.0	44.4	18.5	0.0	0.0

Table 29 addresses the availability of consumable and non-consumable supplies for science. At the middle level, fewer teachers reported on the post-survey that none or all of the consumable science supplies were purchased compared to the pre-survey. On the post-survey more middle level teachers (33 percent) reported some of the consumable supplies being purchased compared to the pre-survey (26 percent). At the high school level, the number of teachers reporting that none, few, some, and most of the consumable supplies decreased on the post-survey compared to the pre-survey. A substantial increase of 33 percent was reported in the number of high school teachers indicating on the post-survey that their schools purchased all of the consumable science supplies compared to the pre-survey response.

Table 29 also reports on the frequency at which non-consumable supplies were purchased by the schools. At the elementary level a decrease in the number of teachers reporting that none, few, and some of the non-consumable materials were purchased was reported on the post-survey compared to pre-survey responses. The post-survey responses indicated increases in the number of elementary teachers reporting that most or all of the non-consumable supplies were purchased. At the middle level, the trend was opposite that reported by elementary level teachers. The number of middle level teachers reporting that none, few, and some of the non-consumable supplies were purchased increased on the post-survey. However, a decrease was reported for the number of teachers reporting on the post-survey that most or all of the non-consumables were made available by schools. High school teachers reported more schools purchasing some of the non-consumable supplies and fewer schools purchasing most of the supplies when post-survey was compared to pre-survey responses.

Table 29. Consumable and Non-Consumable Supplies for Science

Item	Grade Level	n	Mean (SD)	Frequency Percentages				
				None (1)	Few (2)	Some (3)	Most (4)	All (5)
How many needed consumable science supplies are regularly purchased by your school?	K-5 pre	406	2.80 (1.16	15.0	26.8	28.6	22.7	6.9
	6-8 pre	76	3.08 (1.18)	9.2	25.0	26.3	27.6	11.8
	post	63	3.06 (1.03)	4.8	27.0	33.3	27.0	7.9
	9-12 pre	30	4.10 (0.86)	1.3	15.8	34.2	36.8	11.8
	post	27	4.19 (0.88)	0.0	3.7	18.5	33.3	44.4
How many of the non-consumable science supplies are available in sufficient quantity for student use?	K-5 pre	409	3.09 (1.07)	5.6	19.9	41.2	26.4	7.0
	post	63	3.40 (0.93)	1.6	15.9	33.3	39.7	9.5
	6-8 pre	76	3.42 (0.94)	0.0	6.7	13.3	43.3	36.7
	post	63	3.40 (0.93)	1.6	15.9	33.3	39.7	9.5
	9-12 pre	30	4.33 (0.61)	0.0	0.0	6.7	53.3	40.0
	post	27	4.15 (0.77)	0.0	3.7	18.5	33.3	44.4

As shown in Table 30, teacher satisfaction with time available for science increased at all levels after two years of participation in the MUSI project. At the elementary level about 49 percent of teachers reported agreeing or strongly agreeing that they have adequate class time for students to learn science on the post-survey compared to the pre-survey (34 percent). After two years in MUSI, 63 percent of middle level teachers agreed or strongly agreed that there was adequate time compared to responses on the pre-survey (57 percent). High school teachers reported an increase of 20 percent in the number of teachers agreeing/strongly agreeing that they had adequate time on the post-survey (52 percent) compared to pre-survey (32 percent).

Table 30. Teacher Satisfaction with Time Available for Science

Item	Grade Level	n	Mean (SD)	Frequency Percentages				
				Strongly Disagree (1)	Disagree (2)	Neutral (3)	Agree (4)	Strongly Agree (5)
I have adequate class time for students to learn science.	K-5 pre	422	2.85 (1.14)	11.8	31.5	22.5	28.0	6.2
	post	277	3.17 (1.18)	7.2	29.2	14.8	36.8	11.9
	6-8 pre	77	3.19 (1.32)	14.3	22.1	6.5	44.2	13.0
	post	63	3.43 (1.10)	1.6	30.2	4.8	50.2	12.7
	9-12 pre	31	2.68 (1.19)	12.9	45.2	9.7	25.8	6.5
	post	27	3.19 (1.11)	3.7	33.3	11.1	44.4	7.4

Teachers reported in Table 31 the number of minutes of science was taught by regular teachers in the elementary school. Most students (76 percent) received more than 31 minutes of science instruction each week. However, 24 percent of elementary students received only 0 to 30 minutes of instruction per week.

Table 31. Number of Minutes of Science Taught by Regular Teacher in Elementary School

Item	Grade Level	n	Frequency Percentages				
			0-30 minutes (1)	31-60 minutes (2)	61-120 minutes (3)	121-180 minutes (4)	181 or more minutes (5)
About how many minutes of science do you teach your students each week?	K5	423	24.3	34.3	28.6	9.7	3.1

Table 32 reports the number of minutes of science taught by another elementary teacher other than the regular science instructor in one week. Thirty-four percent of students receive no additional science instruction beyond what is provided by the regular teacher. Still, 66 percent of elementary students receive additional science instruction each week.

Table 32. Number of Minutes of Science Taught by Another Teacher in Elementary School

Item	Grade Level	n	Frequency Percentages				
			0 minutes (1)	1-30 minutes (2)	31-60 minutes (3)	61-120 minutes (4)	121 or more minutes (5)
About how many minutes of science does someone other than yourself teach your students each week?	K5	423	34.0	17.0	29.6	13.2	6.1

Table 33 shows the total hours of science instruction within the school. Nearly 72 percent of elementary students receive a total of 0 to 120 minutes of science instruction each week. This includes instruction by regular teacher and any instruction provided by another elementary level teacher. Students are most likely to receive between 61 and 120 minutes (44 percent).

Table 33. Post-Survey Total Hours of Instruction within School

Item	Grade Level	n	Frequency Percentages				
			0-60 minutes (1)	61-120 minutes (2)	121-180 minutes (3)	181-240 minutes (4)	241 or more (5)
How many total minutes of science instruction do your students receive each week?	K-5	282	28.0	44.3	18.4	6.7	2.5

As shown in Table 34, more than half (54 percent) of the students at the elementary level receive regular instruction in science from a science specialist.

Table 34. Post-Survey Availability of Science Specialist

Item	Grade Level	n	Frequency Percentages		
			No	Yes	Invalid Response
Does a science specialist provide regular instruction in science to your students?	K-5	278	54.0	44.6	1.5

Assessment Practices

In Table 35, teachers were asked on both the pre-survey and post-survey to report on the frequency in using open-ended questions to evaluate students' learning. At the elementary level, fewer teachers reported on the post-survey (17 percent) that they never used open-ended questions as an evaluative method compared to the pre-survey (28 percent). The number of teachers reporting using open-ended questions once/twice a month increased by 7 percent from pre-survey to post-survey. The largest post-survey increase at the elementary level was in those teachers reporting almost daily use of open-ended questions as an evaluative measure of students learning. Increases in the number of middle level teachers using open-ended questions once/twice per semester and once/twice a month were reported (approximately 7 percent increase in both frequencies comparing pre-survey to post-survey). However, decreases on the post-survey in the number of middle level teachers indicating almost daily or weekly use of open-ended questions were reported. At the high school level, increases of 8 percent on the post-survey were reported in the number of teachers responding to never or almost daily use of open-ended questions, and a decrease of 17 percent was noted in the number of teachers reporting using open-ended questions once/twice a month.

Table 35. Frequency of Utilization of Open-ended Questions in Science Evaluation

Item	Grade Level	n	Frequency Percentages				
			Never (1)	Once/Twice a Semester (2)	Once/Twice a Month (3)	Weekly (4)	Almost Daily (5)
How often do you evaluate students' learning by having them respond in writing to open-ended questions?	K-5 pre	419	28.4	17.9	29.1	21.2	3.3
	post	273	16.5	20.9	36.3	20.9	16.5
	6-8 pre	77	6.5	2.6	23.4	42.9	24.7
	post	63	3.2	9.5	30.2	38.1	19.0
	9-12 pre	31	6.5	16.1	38.7	32.3	6.5
	post	27	14.8	11.1	22.2	37.0	14.8

Teachers were asked on the pre-survey and post-survey to report their frequency of use of authentic performance tasks that require students to use materials or equipment, to collect and organize data, and to draw. At the elementary level, fewer teachers reported never using authentic performance tasks after two years in the MUSI project as shown in Table 36. More elementary teachers (21 percent) indicated on the post-survey that they used authentic performance tasks weekly compared to the pre-survey (16 percent) responses. Middle level teachers reported the greatest increase (10 percent increase) in the number of teachers responding on the post-survey that they used authentic performance tasks twice a month compared to the pre-survey. At the high school level, fewer teachers reported on the post-survey (19 percent) that they used authentic performance tasks weekly compared to the pre-survey (27 percent). More high school teachers reported using them once a month on the post-survey (6 percent increase).

Table 36. Assessment of Science Learning through Authentic Performance Tasks

Item	Grade Level	n	Frequency Percentages				
			Never (1)	Rarely (2)	Once a month (3)	Twice a month (4)	Weekly (5)
How often do you evaluate students' science learning with authentic performance tasks that require students to use materials or equipment, to collect and organize data, and to draw conclusions?	K-5 pre	412	14.1	30.3	25.5	15.5	14.6
	post	275	6.2	29.5	28.4	21.1	14.9
	6-8 pre	77	1.3	16.9	31.2	23.4	27.3
	post	63	0.0	22.2	19.0	33.3	25.4
	9-12 pre	30	0.0	26.7	23.3	23.3	26.7
	post	27	3.7	22.2	29.6	25.9	18.5

Teachers were asked to report whether they use portfolios to evaluate students' science learning. Table 37 shows that comparing pre-survey responses to post-survey some changes are indicated. Middle level teachers were less likely to use portfolios after participating in MUSI for two years (31 percent) compared to the pre-survey (42 percent) responses. Similarly, high school teachers were less likely to use portfolios on the post-survey (62 percent) compared to pre-survey (71 percent). Little change was reported at the elementary level.

Table 37. Assessment of Science Learning through Portfolios

Item	Grade Level	n	Frequency Percentages	
			No	Yes
Do you evaluate your students' science learning by having them prepare portfolios that include student reflection on their learning and samples of student work?	K-5 pre	414	59.2	33.1
	post	275	61.1	32.4
	6-8 pre	77	41.6	55.8
	post	62	30.6	69.4
	9-12 pre	31	71.0	29.0
	post	27	61.5	38.5

Technology

The use of technology is reported in Tables 38 and 39. Table 38 reports the frequency of students' using computers for science. Fewer elementary level teachers reported never using computers in science instruction on the post-survey. An increase of about 5 percent in the number of elementary level teachers using computers in science once/twice a semester was indicated when pre-survey and post-survey were compared. At the middle level, fewer teachers reported on the post-survey never or almost daily using computers compared to the pre-survey. On the post-survey, the number of middle level teachers increased in frequency for teachers reporting using computers in science instruction once/twice a semester or weekly. High school teachers indicated on the post-survey that fewer reported never using computers compared to the pre-survey responses. Both weekly and almost daily use of the computer in science instruction increased on the post-survey at the high school level.

Table 38. Frequency of Students' Use of Computers for Science

Item	Grade Level	n	Frequency Percentages				
			Never (1)	Once/Twice a Semester (2)	Once/Twice a Month (3)	Weekly (4)	Almost daily (5)
How often do your students use computers for science?	K-5 pre	417	50.8	18.2	18.9	10.8	1.2
	post	273	46.5	23.4	17.2	11.0	1.8
	6-8 pre	77	35.1	32.5	19.5	9.1	3.9
	post	62	25.8	40.3	16.1	17.7	0.0
	9-12 pre	31	22.6	41.9	25.8	9.7	0.0
	post	27	14.8	40.7	22.2	18.5	3.7

Table 39 reports on the availability of computers for science on the pre-survey and two years after participating in MUSI. Fewer teachers at all levels reported that computers were not available at all in their schools after two years as a MUSI school. However, a substantial increase from pre-survey to post-survey of nearly 30 percent was reported by high school teachers who indicated that computers were within the school but hard to access. None of the high school teachers had indicated this on the pre-survey. Slight increases in the number of teachers at all levels indicating easy access to computers within the schools were reported on the post-survey. The greatest increase (38 percent, pre-survey; 47 percent, post-survey) in classroom availability of computers was reported at the elementary level.

Table 39. Availability of Computers for Science

Item	Grade Level	n	Frequency Percentages			
			Not available (1)	Within the school but hard to access (2)	Within the school and easy to access (3)	Available in classroom (4)
How available are computers for science instruction?	K-5 pre	416	28.4	20.2	10.6	38.2
	post	271	24.7	15.5	12.5	47.2
	6-8 pre	75	14.7	46.7	21.3	16.0
	post	62	11.3	45.2	27.4	16.1
	9-12 pre	30	10.0	0.0	40.0	10.0
	post	27	7.4	29.6	55.6	7.4

Knowledge, Perceptions, and Beliefs

Table 40 shows the familiarity with the National Science Standards developed by the National Research Council (NRC). Fewer teachers at all levels indicated not being familiar with the NRC standards at all after two years in the MUSI project. Similarly, fewer teachers at all levels reported having heard of the NRC standards, but not knowing much about them comparing pre-survey to post-survey. Substantial increases were reported on the post-survey in the number of elementary (21 percent increase) and middle (24 percent increase) level teachers indicating having some familiarity with the NRC standards. More teachers at all levels indicated being very familiar with the NRC standards when pre-survey is compared to post-survey responses.

Table 40. Familiarity with National Science Standards

Item	Grade Level	n	Frequency Percentages			
			Not at all (1)	Heard of, but don't know much (2)	Somewhat (3)	Very (4)
How familiar are you with the national science standards developed by the National Research Council?	K-5 pre	412	21.4	42.7	24.3	6.8
	post	273	12.1	33.7	45.4	8.8
	6-8 pre	77	16.9	41.6	29.9	7.8
	post	63	4.8	28.6	54.0	12.7
	9-12 pre	31	16.1	35.5	41.9	6.5
	post	27	7.4	25.9	44.4	22.2

Table 41 shows the frequency of responses on the pre-survey and post-survey indicating teachers' ratings of their ability on a number of areas in relation to science instruction. Small decreases in the number of elementary teachers reporting being very weak or weak in the ability to use background content knowledge of science were indicated on the post-survey. Increases in the number of elementary level teachers feeling adequate, strong, and very strong in background content knowledge were reported after the two years in the MUSI project. However, at the middle level, fewer teachers felt adequate, strong, or very strong in background content knowledge and more teachers (12 percent increase) at this level felt weak in this area as

reported on the post-survey. At the high school level, teachers indicated feeling increasingly adequate and strong using background content knowledge after the two years in MUSI, but decreasing about 9 percent in the numbers reporting feeling very strong.

Teachers were asked about confidence in their ability to facilitate inquiry-based activities in science. At the elementary level, teachers reported on the post-survey that fewer felt weak or adequate in this ability and more teachers felt strong facilitating inquiry-based activities after the two years in a MUSI school. Middle level teachers reported a decrease in the number of teachers feeling strong or very strong in this ability. However, more middle level teachers reported on the post-survey that they felt very weak or adequate in the ability to facilitate inquiry-based activities. A substantial decrease of nearly 10 percent was reported in the number of high school teachers feeling weak in this ability and more high school teachers indicated feeling adequate, strong, and very strong.

Table 41 reports on the confidence level of teachers in using computers as an integral part of science instruction. Few changes were seen at the elementary level from pre-survey to post-survey; however, a decrease in the number of elementary teachers reporting feeling very weak and an increase in teachers feeling weak was indicated on the post-survey. Fewer teachers hers at the middle level reported feeling very strong in their ability to use computers in science instruction and more middle level teachers reported feeling weak in this ability when pre-survey was compared to post-survey responses. The most change was reported at the high school level. More high school teachers (13 percent increase) reported feeling very weak in their ability to make computers an integral part of science instruction after participation in the two years of MUSI. A 20 percent increase in the number of high school teachers feeling strong in their ability to use computers was reported on the post-survey. Decreases in the number of teachers feeling weak (10 percent decrease from pre-survey to post-survey) and feeling adequate (23 percent decrease) were reported at the high school level.

Table 41. Perceived Strengths and Weaknesses in Science

Item	Grade Level	n	Mean (SD)	Frequency Percentages				
				Very Weak (1)	Weak (2)	Adequate (3)	Strong (4)	Very Strong (5)
Background content knowledge of science.	K-5 pre	419	3.20 (0.87)	2.1	15.0	52.5	21.7	8.6
	post	274	3.37 (0.86)	1.5	10.6	47.4	30.3	10.2
	6-8 pre	77	3.49 (1.00)	1.3	13.0	40.3	26.0	19.5
	post	63	3.25 (1.06)	1.6	25.4	34.9	22.2	15.9
	9-12 pre	31	4.52 (0.68)	0.0	0.0	9.7	29.0	61.3
	post	27	4.41 (0.69)	0.0	0.0	11.1	37.0	51.9
Ability to facilitate inquiry-based activities in science.	K-5 pre	419	3.06 (0.88)	2.6	22.7	46.8	22.4	5.5
	post	276	3.21 (0.87)	2.2	16.7	44.9	30.4	5.8
	6-8 pre	77	3.53 (0.91)	0.0	11.7	40.3	31.2	16.9
	post	63	3.27 (0.88)	3.2	11.1	49.2	28.6	7.9
	9-12 pre	31	3.65 (0.92)	0.0	9.7	35.5	35.5	19.4
	post	27	3.81 (0.79)	0.0	0.0	40.7	37.0	22.2
Ability to use computers as an integral part of science instruction.	K-5 pre	416	2.16 (1.02)	31.7	31.7	26.7	8.2	1.7
	post	276	2.25 (1.03)	25.0	39.9	23.2	8.7	3.3
	6-8 pre	76	2.58 (1.26)	22.4	30.3	25.0	11.8	10.5
	post	63	2.43 (1.09)	20.6	38.1	22.2	15.9	3.2
	9-12 pre	31	2.65 (0.92)	9.7	32.3	45.2	9.7	3.2
	post	27	2.70 (1.23)	22.2	22.2	22.2	29.6	3.7

As shown in Table 42, teachers were asked to report on their beliefs and attitudes about science on both the pre-survey and two years later (post-survey). In response to the question of whether it is important to learn basic scientific terms and formulas before learning underlying concepts and principles, more teachers at all levels indicated strongly agreeing with that statement on the post-survey compared to pre-survey response. Middle level teachers (increase of 13 percent) reported the greatest increase in numbers of teachers strongly agreeing with that statement compared to high school (12 percent increase) and elementary (5 percent increase) levels. After two years in the MUSI project, more teachers at the elementary level disagreed that learning basic scientific terms and formulas before underlying concepts is important. At the middle level, 17 percent more teachers reported agreeing with that statement on the post-survey. Nearly 20 percent fewer high school teachers indicated that they agreed with that statement on the post-survey (26 percent) compared to the pre-survey (45 percent).

Teachers were asked whether they believed that students learned best in classes consisting of students with similar ability. At the elementary level, about 10 percent more of elementary teachers reported disagreeing with that statement on the post-survey (44 percent) compared to the pre-survey (33 percent) responses. At the middle level, fewer teachers strongly disagreed, however, more indicated continued disagreement with that statement on the post-survey. High school teachers indicated increasing agreement on the post-survey (39 percent)that students learn best in classes of students with similar abilities compared to the pre-survey (26 percent) responses. Still, decreases in the number of high school teachers indicating strongly disagreeing and being neutral to that statement were also reported on the post-survey.

Table 42. Beliefs and Attitudes about Science

Item	Grade Level	n	Mean (SD)	Frequency Percentages				
				Strongly Disagree (1)	Disagree (2)	Neutral (3)	Agree (4)	Strongly Agree (5)
It is important to learn basic scientific terms and formulas before learning underlying concepts and principles.	K-5 pre	420	2.93 (1.15)	11.4	28.1	24.3	28.6	7.6
	post	278	2.99 (1.20)	8.3	35.3	18.7	25.2	12.6
	6-8 pre	76	2.75 (1.26)	18.4	27.6	25.0	18.4	10.5
	post	63	3.46 (1.28)	7.9	20.6	12.7	34.9	23.8
	9-12 pre	31	3.23 (1.06)	3.2	29.0	16.1	45.2	6.5
	post	27	3.15 (1.29)	7.4	33.3	14.8	25.9	18.5
Students learn science best in classes of students with similar abilities.	K-5 pre	421	2.39 (0.097)	16.4	44.2	25.4	11.6	2.4
	post	277	2.38 (0.94)	13.0	53.8	18.1	13.0	2.2
	6-8 pre	77	2.40 (1.08)	19.5	42.9	19.5	14.3	3.9
	post	63	2.51 (1.08)	12.7	49.2	19.0	12.7	6.3
	9-12 pre	31	3.03 (1.14)	9.7	22.6	32.3	25.8	9.7
	post	26	3.27 (1.12)	3.8	26.9	19.2	38.5	11.5
It is important to emphasize broad coverage of many scientific concepts and principles.	K-5 pre	420	3.64 (0.91)	2.6	9.5	21.2	54.5	12.1
	post	278	3.60 (0.95)	1.4	15.8	17.3	52.5	12.9
	6-8 pre	77	3.35 (1.02)	6.5	11.7	31.2	41.6	9.1
	post	63	3.24 (1.07)	4.8	23.8	23.8	38.1	9.5
	9-12 pre	30	3.30 (0.88)	0.0	23.3	26.7	46.7	3.3
	post	27	3.52 (1.09)	0.0	25.9	14.8	40.7	18.5
It is important to integrate science disciplines (e.g. life, earth, and physical sciences).	K-5 pre	*						
	post	*						
	6-8 pre	77	3.92 (1.04)	6.5	2.6	10.4	53.2	27.3
	post	63	4.10 (0.82)	0.0	3.2	19.0	42.9	34.9
	9-12 pre	31	3.87 (0.81)	0.0	3.2	29.0	45.2	22.6
	post	27	3.67 (1.04)	3.7	11.1	18.5	48.1	18.5

* This question was not asked at this level.

Teachers at all levels reported fewer neutral responses on the post-survey compared to the pre-survey when asked whether it is important to emphasize broad coverage of many scientific concepts and principles. Elementary level teachers reported more teachers disagreeing with that statement on the post-survey. Middle level teachers also reported an increase in the number of teachers disagreeing that broad coverage of many scientific concepts is important (12 percent increase on post-survey). At the high school level, 15 percent more teachers reported that they strongly agreed that broad coverage of concepts is important in science instruction on the post-survey compared to pre-survey responses.

Teachers at the middle and high school level were asked to respond to the statement that the integration of science disciplines (e.g. life, earth, and physical sciences) is important during science instruction. Fewer teachers at the middle level reported on the post-survey that they disagreed with that statement. However, fewer middle level teachers (decrease of 10 percent from pre-survey) indicated agreement with that statement as reported on the post-survey. More middle level teachers reported on the post-survey strongly agreeing that integration of science disciplines is important. At the high school level, fewer teachers reported being neutral or strongly agreeing with that statement. More high school teachers indicated that after the two years in a MUSI school they either strongly disagreed or disagreed with that statement.

Table 43 shows the perceptions about science reported only on the post-survey. Teachers were asked to indicate their agreement with the statements shown in Table 42a indicating confidence in their ability to instruct science content effectively. Most teachers at all levels agreed or strongly agreed that they understood science concepts well enough to be effective in teaching science. One hundred percent of high school teachers indicated agreement with this statement compared to middle level (76 percent) and elementary level (79 percent). At the middle level, 10 percent of teachers indicated that they were not confident that they did understand science concepts well enough to be effective in science instruction.

Table 43. Post Survey Perceptions about Science.

Item	Grade Level	n	Mean (SD)	Frequency Percentages				
				Strongly Disagree (1)	Disagree (2)	Undecided (3)	Agree (4)	Strongly Agree (5)
I understand science concepts well enough to be effective in teaching science.	K-5	277	3.94 (0.78)	0.4	5.4	14.8	58.8	20.6
	6-8	63	4.00 (0.98)	1.6	7.9	14.3	41.3	34.9
	9-12	27	4.85 (0.36)	0.0	0.0	0.0	14.8	85.2
Even if I try very hard, I do not teach science as well as I teach most other subjects.	K-5	277	2.58 (1.01)	9.7	48.7	17.3	21.7	2.5
	6-8	62	2.23 (1.05)	24.2	48.4	9.7	16.1	1.6
	9-12	27	1.52 (0.70)	59.3	29.6	11.1	0.0	0.0
I wonder if I have the necessary skills to teach science.	K-5	277	2.23 (0.94)	18.1	55.6	13.0	11.6	1.8
	6-8	63	2.35 (1.09)	20.6	49.2	6.3	22.2	1.6
	9-12	27	1.48 (0.85)	63.0	33.3	0.0	0.0	3.7

Teachers were asked to compare their ability to teach science to their ability to teach other subjects. Elementary teachers (24 percent) were most likely to indicate that they did not teach science as well as they taught most other subjects, even if they tried very hard compared to middle (18 percent) and high school (0 percent) levels. Most high school teachers (89 percent) reported disagreeing or strongly disagreeing with that statement.

Middle level teachers (24 percent) were the most likely to wonder if they had the necessary skills to teach science compared to elementary (13 percent) and high school (4 percent) levels.

Again, most high school teachers (97 percent) indicated disagreeing or strongly disagreeing that they wonder if they have the necessary skills to teach science.

Student Expectations and Policy

Table 44 reveals the changes from pre-survey to post-survey in teachers' expectations of students ability to achieve in the area of science. At the elementary and middle levels, slightly fewer teachers reported none of their current students would be able to think and work scientifically at high levels. Fewer elementary teachers (10 percent decrease from pre-survey responses) reported that few of their students could achieve high levels of scientific thinking. A 12 percent increase in the number of elementary level teachers reporting on the post-survey that some or most of their students could think to high levels compared to pre-survey responses. More middle level teachers reported that some of their students could think to high levels on the post-survey (52 percent) compared to pre-survey (40 percent) responses. However, compared to pre-survey responses, fewer middle level teachers (decrease of 7 percent) report on the post-survey that they believe most or all of their students can achieve this high level of scientific thinking. At the high school level, about 9 percent more of teachers indicate believing that their students can achieve this high level of thinking after two years in the MUSI project. However, a 9 percent increase in the number of high school teachers indicating that few of their students can think to high levels scientifically was reported on the post-survey also.

Table 44. Expectations of Students Ability to Achieve in Science

Item	Grade Level	n	Mean (SD)	Frequency Percentages				
				None (1)	Few (2)	Some (3)	Most (4)	All (5)
Based upon your current class of students, how many them can learn to think and work scientifically at high levels?	K-5 pre	413	3.09 (0.98)	5.6	19.9	41.2	26.4	7.0
	post	275	3.32 (0.85)	2.5	10.2	47.3	32.4	7.6
	6-8 pre	77	3.29 (0.96)	1.3	19.5	40.3	27.3	11.7
	post	63	3.25 (0.84)	0.0	15.9	52.4	22.2	9.5
	9-12 pre	31	3.19 (0.65)	0.0	9.7	64.5	22.6	3.2
	post	27	3.26 (0.86)	0.0	18.5	44.4	29.6	7.4
How many students will be able to achieve the new School Board Policy: Students will demonstrate a high level of proficiency in science equivalent to three years of high school to include the physical, biological, and chemical sciences. Students will demonstrate and understanding of scientific inquiry and its application to real life situations.	K-5 pre	406	3.27 (0.70)	0.5	10.1	53.9	32.8	2.7
	post	268	3.41 (0.69)	0.4	6.7	48.9	39.9	4.1
	6-8 pre	77	3.39 (0.69)	0.0	7.8	49.4	30.0	3.9
	post	63	3.38 (0.73)	0.0	6.3	57.1	28.6	7.9
	9-12 pre	30	3.39 (0.72)	0.0	6.5	54.8	32.3	6.5
	post	26	3.23 (0.71)	0.0	7.7	69.2	15.4	7.7

In February 1996, the MPS School Board adopted a new graduation policy for science. It is effective for the graduating class of 2004. Table 43 reveals the changes from the pre-survey to two years later, after participating in the MUSI project, in teachers' belief that students will be able to meet the new graduation requirements. On the post-survey, teachers at all levels indicated slight increases in the number reporting that they believed that all students would meet the new graduation requirements in science. At the elementary level, fewer teachers indicated that few of their students would meet the graduation criteria comparing pre-survey (10 percent) to post-survey (7 percent) responses. A decrease of 5 percent in the number of elementary teachers reporting that some of their students would be able to meet the requirements was also indicated on the post-survey. Seven percent more of elementary students reported that most students would meet these requirements. At the middle level, an 8 percent increase in the number of teachers reporting that some of their students could meet these

graduation requirements was indicated on the post-survey. Seventeen percent fewer high school teachers responded on the post-survey that most of their students could meet these new standards, and 12 percent more of high school teachers than those on the pre-survey indicated that some students could meet the new School Board graduation criteria.

In table 45, teachers were asked to indicate their level of support for the New School Board policy on both the pre-survey and two years later on the post-survey. Very small changes were reported for teachers at the elementary and middle levels. However, high school teachers reported a large increase on the post-survey (50 percent) in the number of teachers indicating that they were neutral towards the new policy compared to the pre-survey (23 percent). Fewer high school teachers (28 percent) reported strong support of the new policy after two years of participation in MUSI.

Table 45. Level of Support for New School Board Policy in Science

Item	Grade Level	n	Mean (SD)	Frequency Percentages				
				Strongly Opposed (1)	Oppose (2)	Neutral (3)	Strong (4)	Very Strong (5)
Indicate your level of support for the new School Board Policy for science.	K-5 pre	404	3.53 (0.80)	1.7	4.2	43.6	40.3	10.1
	post	254	3.50 (0.75)	0.8	5.1	45.7	40.2	8.3
	6-8 pre	31	3.84 (0.75)	0.0	0.0	37.3	41.3	21.3
	post	63	3.87 (0.83)	0.0	3.2	31.7	39.7	25.4
	9-12 pre	30	3.77 (0.90)	0.0	10.0	23.3	46.7	20.0
	post	26	3.58 (0.95)	0.0	7.7	50.0	19.2	23.1

Table 46 shows the post-survey responses to statements about perception and expectations of students in science. After two years participation in the MUSI project, most teachers at all levels indicated that they strongly disagree or disagree that if students are underachieving in science it is most likely due to ineffective science teaching. Seventy percent of high school teachers disagreed with that statement compared to middle level (56 percent) and elementary level (41 percent) teachers. Middle level teachers (70 percent) were the most likely to report that increased effort in science teaching produces little change in some students' science achievement compared to elementary (63 percent) and high school (48 percent) levels.

Table 46. Post-Survey Perceptions/Expectations of Students in Science

Item	Grade Level	n	Mean (SD)	Frequency Percentages				
				Strongly Disagree (1)	Disagree (2)	Undecided (3)	Agree (4)	Strongly Agree (5)
If students are under-achieving in science it is most likely due to ineffective science teaching.	K-5	278	2.81 (0.99)	8.3	32.7	31.7	24.5	2.9
	6-8	62	2.55 (1.15)	17.7	38.7	21.0	16.1	6.5
	9-12	27	2.26 (1.10)	25.9	44.4	7.4	22.2	0.0
Increased effort in science teaching produces little change in some students' science achievement.	K-5	278	2.50 (0.95)	8.6	54.3	17.6	17.3	2.2
	6-8	63	2.37 (0.97)	11.1	61.9	9.5	14.3	3.2
	9-12	27	2.74 (1.02)	7.4	40.7	25.9	22.2	3.7
The inadequacy of a student's science back-ground can be overcome by good science teaching.	K-5	277	3.71 (0.84)	1.4	6.9	24.5	53.1	14.1
	6-8	63	3.70 (0.93)	1.6	9.5	23.8	47.6	17.5
	9-12	27	3.30 (0.95)	0.0	25.9	25.9	40.7	7.4

Teachers were asked to respond to the statement that the inadequacy of a student's science background could be overcome by good science teaching. Most teachers at all levels reported

agreeing or strongly agreeing with this statement. However, as student's age increases, teachers report increasing disagreement that a student's inadequate science background can be overcome by good science instruction. Elementary level teachers (8 percent) indicated the least disagreement with that statement. More middle level teachers (11 percent) indicated disagreement with that statement. At the high school level, 25 percent of teachers surveyed reported disagreeing that a student's inadequate science background could be overcome by good science teaching.

Teachers were asked about their perceptions of MUSI and the Math Science Resource Teacher (MSRT) on the post-survey. Table 47 shows that middle level teachers (76 percent) are the most likely to report that the MSRT at their schools assisted them in improving science instruction compared to high school (54 percent) and elementary levels (44 percent). At the elementary level, 45 percent of teachers reported that they disagreed or strongly disagreed that the MSRT assisted them in improving science instruction. Nearly 50 percent of teachers at all levels reported that being a MUSI school has allowed improvement in their school's science program. Again, middle level teachers (64 percent) were the most likely to report improvement due to the MUSI program compared to elementary (48 percent) and high school (46 percent) levels. Elementary level teachers (28 percent) were the most likely to disagree or strongly disagree that participation in MUSI allowed their school's science program to improve compared to high school (19 percent) and middle (8 percent) levels.

Table 47. Post-Survey Perceptions of MUSI

Item	Grade Level	n	Mean (SD)	Frequency Percentages				
				Strongly Disagree (1)	Disagree (2)	Undecided (3)	Agree (4)	Strongly Agree (5)
The MSRT at my school has assisted me in improving my science instruction.	K-5	278	2.91 (1.44)	23.7	21.2	11.2	28.4	15.5
	6-8	62	3.90 (1.11)	4.8	9.7	8.1	45.2	32.3
	9-12	26	3.27 (1.25)	15.4	7.7	23.1	42.3	11.5
Being a MUSI school has allowed us to improve our school's science program.	K-5	279	3.26 (1.31)	14.3	13.3	24.4	28.3	19.7
	6-8	63	3.75 (1.02)	4.8	3.2	28.6	39.7	23.8
	9-12	26	3.23 (0.99)	7.7	11.5	34.6	42.3	3.8

Professional Development and Collaboration

Teachers were asked on both pre-survey and post-survey to indicate their degree of agreement with the statements shown in Table 48. Teachers at the middle level reported a 15 percent increase in the numbers agreeing or strongly agreeing that they feel supported by colleagues compared to changes from pre-survey to post-survey at the elementary (10 percent increase) and high school (4 percent increase) levels. Few or small changes were reported by teachers at the elementary and middle level when asked if teachers in their school regularly share ideas and materials about science when comparing pre-survey responses to post-survey responses. At the high school level, the greatest change was reported for teachers at either extreme of the continuum. High school teachers reported an 11 percent increase on the post-survey in those strongly disagreeing that teachers shared ideas and materials. Sixteen percent more high school teachers also reported strongly agreeing with that statement when pre-survey (10 percent) and post-survey (26 percent) responses were compared.

Teachers were asked to report their agreement with the statement that they have many opportunities to learn new things about science in their present job. At the elementary level, 14 percent more teachers reported on the post-survey (62 percent) that they agreed or strongly agreed with that statement compared to the pre-survey (48 percent) responses. Middle level

teachers reported a 13 percent increase in the number of teachers agreeing or strongly agreeing that they have opportunities in their job to learn new things about science. At the high school level there was little increase in the number of teachers reporting on the post-survey that they agreed with this statement.

On both the pre-survey and two years later, teachers reported the level of involvement in specific efforts to narrow achievement gaps in science between ethnic, gender, and income groups. Thirty-five percent more of high school teachers reported on the post-survey (67 percent) that they agreed or strongly agreed that they had been involved in specific effort to narrow achievement gaps compared to the pre-survey (32 percent) responses. Middle level teachers reported a similar increase (22 percent increase) comparing the post-survey to the pre-survey. Only a small increase of 6 percent in the number of elementary teachers agreeing that they were involved with specific efforts was reported on the post-survey.

Table 48. Peer Collaboration and Support in Science

Item	Grade Level	n	Mean (SD)	Frequency Percentages				
				Strongly Disagree (1)	Disagree (2)	Neutral (3)	Agree (4)	Strongly Agree (5)
I feel supported by colleagues to try out new ideas in teaching science.	K-5 pre	421	3.59 (1.06)	5.9	8.1	24.7	43.7	17.6
	post	277	3.83 (0.94)	1.8	7.9	19.1	48.0	23.1
	6-8 pre	77	3.70 (1.22)	9.1	5.2	22.1	33.8	29.9
	post	63	4.05 (1.10)	4.8	6.3	9.5	38.1	41.3
	9-12 pre	31	4.13 (0.96)	3.2	0.0	19.4	35.5	41.9
	post	27	4.19 (1.04)	3.7	3.7	11.1	33.3	48.1
Teachers in this school regularly share ideas & materials about science.	K-5 pre	422	3.20 (1.03)	5.2	21.8	28.9	36.3	7.8
	post	277	3.16 (1.10)	7.6	22.7	23.1	39.0	7.6
	6-8 pre	77	3.22 (1.22)	13.0	15.6	18.2	42.9	10.4
	post	63	3.52 (1.31)	7.9	19.0	14.3	30.2	28.6
	9-12 pre	31	3.58 (0.88)	0.0	16.1	19.4	54.8	9.7
	post	27	3.70 (1.30)	11.1	11.1	0.0	51.9	25.9
I feel that I have many opportunities to learn new things about science in my present job.	K-5 pre	418	3.26 (1.05)	5.5	20.1	26.6	38.8	9.1
	post	276	3.48 (1.09)	5.1	17.8	14.9	48.6	13.8
	6-8 pre	77	3.16 (1.34)	14.3	23.4	10.4	36.4	15.6
	post	63	3.67 (1.18)	4.8	15.9	14.3	38.1	27.0
	9-12 pre	31	3.55 (1.26)	6.5	19.4	12.9	35.5	25.8
	post	27	3.56 (1.25)	11.1	7.4	18.5	40.7	22.2
I have been involved in specific efforts to narrow achievement gaps in science between ethnic, gender, and income groups.	K-5 pre	420	2.94 (1.03)	5.2	25.0	38.1	22.1	9.5
	post	276	3.16 (1.05)	5.8	24.6	23.9	39.1	6.5
	6-8 pre	77	3.21 (1.26)	18.2	24.7	28.6	16.9	11.7
	post	63	3.38 (1.10)	3.2	22.2	23.8	34.9	15.9
	9-12 pre	31	3.19 (1.17)	12.9	32.3	22.6	25.8	6.5
	post	27	3.52 (1.19)	11.1	7.4	14.8	51.9	14.8

Table 49 shows the change in the number of hours of professional development in science during 1995-1996 (pre-survey) and 1996-1998 (post-survey years). Elementary level teachers reported very little change in the number of hours spent in professional development related to science. At the middle level, a substantial decrease (17 percent decrease) was reported by teachers indicating no professional development in 1995-1996 (25 percent) compared to teachers reporting that in 1997-1998 (8 percent). At the high school level, a 26 percent decrease in the number of teachers reporting zero hours of professional development in 1995-1996 (33 percent) was reported compared to teachers reporting no professional development in 1997-

1998 (7 percent). At the high school level, a substantial increase was reported for those teachers indicating 36 or more hours of professional development in science. In 1995-1996, high school teachers reported zero hours of professional development. In 1996-1997, 26 percent of high school teachers reported 36 or more hours, and in 1997-1998, 15 percent of high school teachers reported the same.

Table 49. Number of Hours of Professional Development in Science during 1995-96

Item	Grade Level	n	Frequency Percentages				
			0 Hours (1)	1-5 Hours (2)	6-15 hours (3)	16-35 hours (4)	36 or more (5)
From September 1995 to August 1996, what is the total amount of time you spent on staff development in science? (Post data includes time spent on staff development from September 1996 through August 1997, and September 1997 through August 1998).	K-5 '95-96	406	20.9	41.9	26.4	5.4	5.4
	'96-97	274	19.7	44.5	22.6	8.4	4.7
	'97-98	273	19.8	46.5	23.4	5.1	5.1
	6-8 '95-96	75	25.3	32.0	18.7	9.3	14.7
	'96-97	63	23.8	15.9	25.4	19.0	15.9
	'97-98	63	7.9	30.2	23.8	17.5	20.6
	9-12 '95-96	30	33.3	23.3	20.0	23.3	0.0
	'96-97	27	7.4	29.6	18.5	18.5	25.9
	'97-98	27	7.4	40.7	25.9	11.1	14.8

Impact of MUSI on Science Instruction

Elementary teachers and science teachers at the middle and high school levels responded to this question: What is the biggest impact MUSI has had on your science instruction? The responses were categorized by emergent themes at each level. The list of categories with frequency and the percent of teachers responding in each category are given for each level. The prevalent themes are summarized with representative teacher responses.

Elementary School MUSI Impact

One hundred and seventy-two teachers at 27 elementary schools gave 224 responses. Table 50 identifies the responses given, as well as the frequency and the percent of teachers responding in each category. Overall, 73 percent or 163 responses indicated a positive impact of MUSI on their science instruction. The other 39 percent or 76 responses indicated reported that MUSI made little or no impact or that they were unfamiliar with the initiative.

Table 50. Impact of MUSI on Science as Reported by Elementary School Teachers

Impact	Frequency	Percentage
Improved Access to Materials and Supplies	34	15.2%
Improvement in Instructional Method	26	11.6%
MSRT as Mentor and Support	21	9.4%
Increased Assistance in Classroom	19	8.5%
Generation of Ideas	17	7.6%
Increased Focus on Standards	10	4.5%
Improved Inservices and Workshops	9	4.0%
Access to UWM Classes	8	3.6%
Improvement in Student Learning	3	1.3%
Increased Preparation Time	3	1.3%
Introduction to Guidelines and Objectives	2	0.9%
Miscellaneous Impact of MUSI	11	4.9%
Little or No Impact Resulting from MUSI	61	27.2%

Improved Access to Materials and Supplies. Elementary teachers indicated that a major impact of MUSI was the availability and support in locating resources and materials needed for science instruction. Teachers reported several main areas in which MUSI changed their experience: obtaining supplies for science, availability and use of science kits, and using the MSRT as a resource for tools/supplies for science instruction.

- MUSI provided me with materials to more easily present materials to students for use in science activities.
- MUSI has made it easier for me to access materials and equipment needed of science instruction. Special materials to infuse into the thematic teaching of science helped immensely.
- Provided me with materials that I was unable to afford and get my hands on myself.
- My MUSI coordinator has made supplies and materials more readily available.

Improvement in Instructional Methods. Elementary teachers indicated a major impact on their instructional style and methods. Themes emerging from the responses included increased use of the science process, inquiry-based investigation, and use of the MPS science kits.

- MUSI helps align process skills and content with assessment.
- MUSI has helped me change from activity oriented to inquiry oriented instruction.
- The focus is on hands on and scientific method to design experiments, expand questioning, and scientific thinking.
- I now know what it means to have children walk through the scientific process. I have seen the direct correlation between science and other areas. It helps me integrate more the major curriculums. We also journal and write with each lesson.
- Being able to teach the scientific process in a more confident manner. My style of teaching has been altered.

MSRT as Mentor and Support. Elementary teachers reported that MUSI's impact was in many ways related to the addition of the Math/Science Resource Teacher. Areas which the MSRT provided assistance included in-class assistance and modeling, leadership and motivation, and additional resource contact for science teachers.

- MUSI MSRT is very necessary to our school's science program. This person should be kept as support person in our building.
- Help was available when requested from the MSRT, especially in planning and tying science to thematic approach to learning.
- I have learned so much from my MUSI teacher. I am much more confident as a science teacher. I am not afraid to try new things, to venture out.
- Our MUSI instructor helped me achieve my science fair goal for an experiment the students could do, put together, research, and fully explain the processes and outcomes. It was a big success.
- I've blended my style of teaching with the modeling I've received from the MUSI teacher to become much more effective.

Increased Assistance in Classroom. Support for science instruction was indicated by the elementary teachers as a vital area in which MUSI's impact emerged. Teachers reported that support for school wide projects as well as science instruction changed how science was approached by teachers and students alike. Assistance usually came from the MSRT (assistance specific to classroom instruction), however, school-wide projects and initiatives were reported to have supported learning within the classroom.

- The extra classroom/laboratory is a rich environment that I could not replicate within my room.
- Support was provided for school wide science program, the creation of school science kits, and support in science assessment.
- The MSRT comes into the classroom to teach and assist.
- The MSRT helps supervise and direct the children in hands on science activities.

Generation of Ideas and Suggestions. Teachers reported that MUSI provided additional ideas and suggestions related to science instruction. The main areas in which ideas/suggestions were impacted include new concepts for instruction, brainstorming with the MSRT, and suggestions for increasing effective instruction.

- Increased up to date information regarding expectations and effective approaches.
- The willingness to discuss and share ideas and responses with class.
- I received publications and watched a video showing a science fair.
- Ideas, new and different experiments for the same concept. This made me excited and thus children were.
- I received much feedback to questions or problems I encountered.

Increased Focus on Standards. Increased awareness of standards and methods of teaching which assist students to achieve proficiency were impacted for some teachers. MUSI was able to provide increased exposure and motivation for teachers to help students in this area.

- MUSI is helping make more teachers aware of what is needed for children to be proficient in science.
- MUSI allowed sharing ideas to help align science teaching with performance assessments and national standards.
- It provided awareness of standards, added focus to teaching content.
- Encouraged me to set higher standards.

Little or No Impact Resulting from MUSI. Nearly 30 percent of elementary teachers indicated that little or no impact resulted from MUSI. Teachers reported little impact on their instructional style, not receiving assistance from the MSRT, and not knowing of the presence of the MSRT within the school.

- I am new here-working as a long-term sub in science. I have not been here long enough to receive any impact from MUSI.
- I have provided more help to the MSRT than I got. I asked for two things and got one thing answered.
- None. The one inservice I attended was more beneficial than what the MSRT has been. The MSRT was to come to my room, but hasn't. No support in ideas or working with students.
- The MSRT has helped the science teacher, but has done very little for individual classrooms.
- Again, our assigned MUSI teacher has provided no support, no guidance, no materials. The MSRT ignored all my requests for assistance even to the simplest things.
- No impact at all. The idea behind the MUSI program is great– if you get a teacher who is willing to work and do the requirements of the job. We didn't, so our students missed a great opportunity.
- None. This program was just an opportunity for some to get out of the classroom. I don't need any more help. I need people to take students and be responsible for them.
- None. MUSI instructor and money not finding its way to the classroom.

Middle School MUSI Impact

A total of 39 science teachers gave 60 responses. Table 51 identifies the responses given, as well as the frequency and the percent of teachers responding in each category. Overall, 88 percent or 53 responses indicated a positive impact of MUSI on their science instruction. The other 12 percent or 7 responses indicated reported that MUSI made little or no impact.

Table 51. Impact of MUSI on Science as Reported by Middle School Teachers

Impact	Frequency	Percentage
Improved Inservices/Staff Development	10	16.7%
Improved Access to Materials/Supplies	9	15.0%
Alignment and Enhancement of Curriculum	9	15.0%
MSRT as Mentor and Support	8	13.3%
Improvement in Instructional Method	6	10.0%
Improved Activities and Lessons	4	6.7%
Improved Dialog Among Teachers	4	6.7%
Access to UWM Classes	3	5.0%
Little or No Impact Resulting from MUSI	7	11.7%

Improved Inservices and Staff Development. Teachers reported that staff development and inservices were greatly impacted by MUSI. Middle school teachers indicated that inservices were applicable to science instruction and to increasing the effectiveness of classroom curriculum.

- MUSI has had the biggest impact on my science teaching through staff development.
- Science support in regard to professional development opportunities and inservices.
- Being a new teacher not certified in science, it has offered me a great opportunity to get knowledgeable about what I am teaching. MUSI has allowed me to grow tremendously in my science teaching.
- The inservice held after school for math and science teachers, taught by our MSRT was the most helpful to me as a new teacher.

Improved Access to Materials/Supplies. MUSI had an impact on the availability of materials and supplies. Middle school teachers reported that materials were purchased and funds became available for such purchases.

- The biggest impact MUSI has on our science instruction would be generating funds to buy various types of equipment.
- We have been given monies to buy equipment for the science department. We were able to purchase a wonderful physics program.
- I am able to obtain additional material to assimilate into the curriculum. This provides an opportunity to include resources that address the various learning styles of the students.
- I feel I've had more help preparing supplemental lessons with the kits and supplies.

Alignment and Enhancement of Curriculum. Middle school teachers reported that curriculum was enhanced due to MUSI. Curriculum was likewise brought into alignment with standards set by the MPS school board. Teachers reported an increasing awareness of national standards for science and increased effectiveness in helping students reach those standards.

- The science curriculum has also impacted the effectiveness of my science instruction.
- MUSI made me aware I was not meeting national or state science standards and I needed to redo my curriculum for the year.

- The MSRT has been a great help in helping me reach the school board policy. I don't know where I would be right now without MUSI.
- MUSI has organized and taught our new curriculum along with our person in charge of our science lab. MUSI is helping me with the curriculum.

MSRT as Mentor and Support. Middle school teachers reported that the MSRT was a vital support in many ways, providing classroom assistance, giving helpful feedback, and working towards the inclusion of all students into MUSI's program.

- The MSRT was always available to help when I had questions.
- MUSI made our school involve exceptional education students in all assessments and science activities. My students were never included before the MSRT came to our school.
- Working one-on-one with our school's MSRT was the greatest impact.
- Our MSRT has helped me through helpful feedback, letting me know that what I am doing is the right thing.

Improvement in Instructional Methods . Several teachers reported that instructional styles and methods were impacted by MUSI. Science content and process standards were being met more effectively. Increased ability to utilize different teaching methods was also impacted.

- The MSRT went through the science content and process standards with me. It is the first time anyone in MPS told me what I would be teaching beyond handing me a textbook. Then the MSRT helped me actually teach content and process together.
- We are more informed of science information.
- It has given some very much needed direction. I am now able to understand where I am to take the student and specifically what it is they should have mastered once I am done.
- MUSI has given more direction to a variety of teaching styles and simple integration of other subjects that don't overpower the science being taught.

Little or No Impact Resulting from MUSI. Ten percent of middle school teachers reported little or no impact of MUSI.

- MUSI is OK, however, I don't feel MUSI can prepare anyone who isn't a person with a strong science background. I know very little about science, and I'm not in a science room. (Lab setting). All the 8th grade teachers are new to teaching science or new to teaching. The lab is available if you sign up, but there is no support, or anyone to help you.
- I came in January so it is a limited amount.

High School MUSI Impact

A total of 17 science teachers gave 25 responses. Table 52 identifies the responses given, as well as the frequency and the percent of teachers responding in each category. Overall, 76 percent or 19 responses indicated a positive impact of MUSI on their science instruction. The other 24 percent or 6 responses indicated reported that MUSI made little or no impact.

Table 52. Impact of MUSI on Science as Reported by High School Teachers

Impact	Frequency	Percentage
Development of More Complex Labs	5	20.0%
MSRT as Mentor and Support	4	16.0%
Improved Ability to Integrate Technology	3	12.0%
Improvement on Instructional Methods	3	12.0%
Assistance in Acquiring Grants	2	8.0%
Miscellaneous Impact of MUSI	2	8.0%
Little or No Impact Resulting from MUSI	6	24.0%

Development of More Complex Labs and Projects. High school teachers reported MUSI as impacting on the science lab and projects. Increasing complexity in the lab and classroom have been attributed to MUSI.

- MUSI allowed us to expand projects for our students to become involved in.
- MUSI provided the ability to do complex labs that require more supervision than I alone can provide.
- I learned to do several hands on labs that are directly connected to real life problems and situations.
- I think it has helped in biology. It gives hands on experience with problems we're facing today.

MSRT as Mentor and Support. MSRTs were credited with providing workshops, added support, and technological assistance.

- The MSRT has also done research for information, connected with other schools, the Internet, and publishers. This saved me a considerable amount of time.
- The MSRT used TI-83 and CBL with two classes which I would not have done without the help of the MSRT.

Improved Ability to Integrate Technology. High school teachers reported that MUSI assisted them in integrating technology into science classes and instruction.

- MUSI helped in integrating technology into the curriculum (i.e. using the TI-83 graphing calculators).
- Helped with technology including the use of calculators.
- Improved teacher understanding of graphing calculator and CB Lab probes.

Improvements in Instructional Methods. Instructional style and method were indicated as being impacted by MUSI. New approaches and an integration of math and science were the main themes which teachers indicated as being salient.

- MUSI has helped in the class room.
- MUSI offered new approaches.
- Some math/science integration.

Little or No Impact. Twenty percent of the high school teachers' responses indicated that little or no impact was reported.

- I believe that MUSI has had no impact on science instruction at our school. It seems to me that MPS does not value science as much as it does math. The focus for MPS and MUSI is to improve math scores. Our science budget for science supplies has been cut over 70%. Money is being spent on computers. Hands on science appears to be unimportant.
- Not much. Our MSRT works almost exclusively with the math and 9th grade teachers.

Support Provided by MSRT

Teachers at all levels were asked to respond to the following: Comment on the support provided to you and your school by the MUSI Mathematics/Science Resource Teacher (MSRT) assigned to your school. The responses were categorized by emergent themes at each level. The list of categories with frequency and the percent of teachers responding in each category are given. The prevalent themes are summarized with representative teacher responses.

Elementary School Mathematics and Science MSRT Support

One hundred and fifty-five teachers gave 190 responses. Table 53 identifies the responses given, as well as the frequency and the percent of teachers responding in each category. Overall, 67 percent or 127 responses indicated support provided by the MSRT. The other 33 percent or 63 responses indicated little or no support provided by the MSRT.

Table 53. Support Provided by the MSRT in Elementary Mathematics and Science

Support	Frequency	Percentage
Supportive of Teachers	40	21.0%
Available and Willing to Consult	19	10.0%
Provided Access to Materials	16	8.4%
Resource for Ideas and Suggestions	13	6.8%
Modeling and Demonstrating Lessons	8	4.2%
Provided Classroom Assistance	6	3.2%
Conducted Inservices and Workshops	5	2.6%
Improved Instructional Methods Taught	3	1.6%
Miscellaneous Supports	13	6.8%
Little or No Support Provided	51	26.8%
Limited Time or Hectic Schedule	12	6.3%

Supportive of Teachers. Elementary teachers (21 percent) reported that the MSRT provided support in a number of areas: introduction of new instructional concepts and tools. providing support in the classroom. and providing feedback to teachers.

- Our MSRT has been very helpful with any questions and coordination of classes to complete all areas of math and science for our grade level. Released time for meetings with the MSRT have been helpful. The MSRT has become an integral part of our staff.
- I think I would be lost without the terrific support from our MSRT. The MSRT has not only supported us but actually comes in and works together so I can see and do what is being talked about. The MSRT's enthusiasm in both areas is contagious. I wish we could keep this person on because it's that extra push to carry on we all need from time to time.
- While it was very helpful to have a MSRT in our building to get us started, we lost our MSRT and no one filled the position. We are now right back where we started, floundering, our cohesiveness is completely lost.
- Our MUSI person was very helpful and patient in developing our program. The MSRT helped us focus and expand our science program in a cooperative way.

Available and Willing to Consult. Ten percent of elementary teachers indicated that the MSRT was available and willing to provide assistance. Salient themes included the MSRT being very approachable, team teaching and learning, and openness to questions.

- The MSRT was available whenever we asked for assistance in a lesson or for advice on a thematic lesson.

- MSRT has been accessible. Excellent in teaching the scientific methods. I've never felt this confident in my teaching of science and it's basically due to MUSI.
- The MSRT made MUSI available in a practical, nonthreatening way. The MSRT has enriched my math and science program, because I was open to learning and trying new things. This person did face some opposition in our school, but helped the staff see where change was needed and left it up to individual staff members to change as they saw fit. Time is the biggest constraint in my program and until the kindergarten programs change to all-day, good science and math implementation will continue to be hit and miss.
- Knowing that I was a first year teacher, the MSRT was always available to me. The MSRT has come into my room to watch me teach a concept and then given me constructive criticism.

Provided Access to Materials and Supplies. Elementary school teachers indicated that the MSRT was able and willing to be a resource for materials/supplies.

- Having an MSRT in our building has made science supplies a great deal more accessible. The MSRT has also built up our supply of both math and science materials.
- The MSRT has provided me with instruction, materials, and resources necessary for me to now really enjoy teaching math. My students have really enjoyed math and learning other problem solving strategies. They have learned to work well with each other. I would hope we could get a full time MSRT as we approach a new century.
- The MSRT has given me numerous math and science resources and helped me make my own. The MSRT has been an invaluable resource to me.

Resource for Ideas and Information. Teachers also indicated that having a new resource for ideas and current information was a source of assistance and motivation for them.

- The MSRT is highly valuable as a resource in this school. I would like to see the teacher become more available.
- Our MSRT brought us books and materials. The MSRT wrote grants and set up our new elementary science lab, but then left to take another position and we really miss the input.
- An excellent resource and guide to implementing instruction in the classroom. Provided guidance and ideas for integrating math and science activities.
- Forwards ideas, classes, accepted my ideas, allowed me to feel comfortable when an experiment didn't work.
- It has been good to have someone who can specialize in the science/math areas to bounce old ideas out that needed to go and brought confirmation of new ideas.

Little or No Support Provided. Nearly 30 percent of teachers reported that there was little or no impact due to the MSRT. Areas in which the MSRT did not meet expectations included being unavailable, not having the content knowledge teachers wanted/needed, or having no contact with the MSRT at all.

- Who recommends them for this position? Who supervises their work and evaluates them? From what I've seen of the program, it's another way of moving ineffective teachers out of the classroom.
- I am highly disappointed in our MUSI resource teacher. The person is intelligent, but has shown no initiative, no follow-up, no cooperation, no sharing. I have heard from teachers in other schools how effective their MUSI resource teachers are. I'm afraid we have wasted money and opportunity because of this person's inadequacy.

- The MSRT has never been to my room, nor have I received written suggestions. In spite of repeated requests, we have received no help. When I hear of the wonderful things happening in other schools with MUSI help, I feel cheated.
- Our MUSI resource teacher was very disappointing to me. This person spent very little time in my classroom and when the person did come in, it was not a planned time between us so it was more interrupting to my teaching and my children's learning. When I would ask for help with a particular topic I often got a reply like I'll get back to you after I do more searching, but rarely did.
- The MSRT walks into my class without notice, sits in and at times steps in without talking with me ahead of time. I welcome an extra set of eyes, mind, hands, but it would be nice to be asked if it's okay to come into my class.
- Our MUSI MSRT has done very little for our school. This person seems to just fill our mail boxes with ideas that most of us have seen before. The MSRT won't have anything to do with the children. Even when asked to go on a field trip the person said no. The MSRT is not child-centered which I believe creates problems.

Limited Time and Hectic Schedule. Some teachers also indicated that the MSRT was too limited in the time they had available for teachers. The hectic schedule and over-extended nature of the MSRT's position were reported as draw-backs in relation to teachers getting their needs met through the MSRT.

- The MUSI teacher is very willing to give assistance, however our school is too large for one person on a part-time basis.
- MUSI has been supportive but there is not enough time for all teachers to get equal time.
- The MSRT usually did anything we asked for or needed assistance with, but the person is spread between schools.
- I think it would be more effective if there was one MSRT per school. That way every teacher would receive math/science input.

Middle School Mathematics MSRT Support

Fifty-one mathematics teachers from 13 middle schools gave 97 responses. Table 54 identifies the responses given, as well as the frequency and the percent of teachers responding in each category. Overall, 94 percent or 91 responses indicated support provided by the MSRT. The other 6 percent or 6 responses indicated little or no support provided by the MSRT.

Table 54. Support Provided by MSRT in Middle School Mathematics

Support	Frequency	Percentage
Helpful and Willing When Approached	14	14.4%
Supportive of Teacher	13	13.4%
Resource for Ideas and Suggestions	12	12.4%
Provided Classroom Assistance	12	12.4%
Provided Access to Materials and Supplies	11	11.3%
Performs Beyond Minimum Expectation	6	6.2%
Conducts Inservices and Committee Meetings	5	5.2%
Available for Consultation	4	4.1%
Organized and Assists in Planning	3	3.1%
Modeled Lessons	3	3.1%
Highlighted Proficiency Standards	3	3.1%
Miscellaneous Supports	4	4.1%
Little or No Support Provided by MSRT	6	6.2%

Helpful and Willing When Approached. Teachers reported that when they sought out assistance, having a well-trained individual available was viewed as extremely helpful.

- The MSRT is always helpful, positive, supportive, and realistic.
- Our MSRT has been a Godsend. This person has helped me when my team members have promised but repeatedly failed.
- I'm not sure of the MSRT's schedule, but this person has been helpful every time I needed something (not always right away).
- If I ask the MSRT for help, this person will take the time to help me as well as my students.
- Thanks for all of your help. You saved me a lot of stress especially in our first year.

Supportive of Teachers. Middle school mathematics teachers reported that the supportive atmosphere created by the MSRT was of assistance to instruction and curriculum.

- The MSRT has supported me in every instance I have asked for it.
- The support for the other teachers in the school helped them in significant ways. As inexperienced teachers they need a lot of support.
- Both years I felt well supported. This year I didn't work often with the MSRT due to the three new science teachers needed more help than me.

Resource for Ideas and Suggestions. Teachers responded to the open-ended question regarding the MSRT's impact by highlighting the generation of new, fresh ideas and helpful suggestions related to curriculum and instruction.

- The MSRT gives me all kinds of information on conferences and workshops, and gives helpful articles, problems, ideas.
- The MSRT is extremely knowledgeable and is excellent in conveying thoughts and ideas to us. We couldn't have picked a better MSRT.
- The MSRT has given lots of insight and great suggestions to add to lessons and lesson planning.
- Kept updated and well informed of various resources.

Provided Classroom Assistance. In-class assistance was reported as an important impact which the MSRT had on instruction. Guidance, keeping instruction plans focused and on-track, increased preparation time for teachers, and demonstrating instructional techniques were reported as ways in which the MSRT impacted classroom performance.

- I had an extra teacher in my room, when I did hands on activities. The MSRT was very helpful in preparing me for class and keeping students on track, while doing hands on activities.
- The MSRT has provided assistance in the operation of different technologies in the classroom.
- It gives me more time to evaluate student learning when I don't have to spend my preparation time gathering supplies.
- Gets us performance tasks. Meets with us on banking day. Makes us feel that we are not alone.

Little or No Support Provided. A small percentage of responses reported that the MSRT had little or no impact on their performance or instruction of mathematics.

- Our MSRT is not readily available. It is difficult to get a hold of the MSRT.
- Our MSRT has not been very helpful but others have. I see very little of what this person is doing. The MSRT doesn't plan anything, just sometimes sits in room and watches.

- I realize that the MUSI teacher is working with the regular classes, but I teach Ex Ed and the support has been minimal.
- Our MSRT is of little/no help with mathematics.

Middle School Science MSRT Support

Forty-one science teachers from 10 middle schools gave 67 responses. Table 55 identifies the responses given, as well as the frequency and the percent of teachers responding in each category. Overall, 67 percent or 127 responses indicated support provided by the MSRT. The other 33 percent or 63 responses indicated little or no support provided by the MSRT.

Table 55. Support Provided by MSRT in Middle School Science

Support	Frequency	Percentage
Supportive to Teachers	12	17.9%
Available/Helpful When Approached	10	14.9%
Able to Procure Materials/Funds	9	13.4%
Assisted with Curriculum Development	7	10.4%
Performs Beyond Minimum Expectation	4	6.0%
Resource for Ideas/Suggestions	3	4.5%
Assisted with Science Fair	3	4.5%
Improvement in Instruction	3	4.5%
Miscellaneous Supports	7	10.4%

Supportive of Teachers. Many teachers reported that the MSRT assigned to their school proved to be supportive to their endeavors and efforts.

- Our MSRT has been very supportive although emphasis has been more on math than science.
- You couldn't ask for better support, helpfulness, and encouragement.
- Strong support is given to all teachers by our MSRT.

Helpful and Available When Approached. Nearly 15 percent of teachers reported that their MSRT was available and helpful.

- Our MSRT this year has been active, vocal, and extremely helpful in improving our science teaching.
- Our MSRT is very helpful in school wide events and in the classroom. It is truly a pleasure to have such a great MUSI representative.
- The MSRT is more than willing to help in whatever is needed.
- The MSRT was always available to offer any assistance. This has been very beneficial.

Able to Procure Materials and Funds. Many responses indicated the benefit of having a resource person with access to materials and the funding needed to attain needed materials.

- The MSRT has been a real help in finding resources to teach the many topics we have to teach during our three year rotation of science topics.
- Our MSRT has been very helpful in getting materials.
- Our MSRT has helped greatly by procuring funds.
- I've had much help getting supplies for experiments and the kits were helpful too.

Assisted with Curriculum Development. Some teachers indicated that the MSRT was able to assist in the development of curriculum and help coordinate existing curriculums.

- Our MSRT has been invaluable, especially in helping with developing curriculum for substitute teachers (we have one position filled by a long term sub). The MSRT has also been instrumental in helping develop and coordinate middle and high school curriculums.
- Helped in the development of science units
- The MSRT did a lot to make me teach the MPS middle school curriculum. Every unit I taught, the MSRT asked/discussed with me the content statements and process skill outcomes.
- The MSRT lead our curriculum committee and helped our new guidance counselors implement assessments.

High School Mathematics MSRT Support

Of the 28 responses, most indicated a positive support due to the MSRT. Table 56 identifies the responses given, as well as the frequency and the percent of teachers responding in each category. Overall, 71 percent or 20 responses indicated support provided by the MSRT. The other 29 percent or 8 responses indicated little or no support provided by the MSRT.

Table 56. Support Provided by MSRT in High School Mathematics

Support	Frequency	Percentage
Available and Willing to Help	10	35.7%
Resource for Ideas and Suggestions	2	7.1%
Provided Access to Materials/Supplies	2	7.1%
Acted as Liaison and Networking	2	7.1%
Provided Tutoring for Students	2	7.1%
Miscellaneous Supports	2	7.1%
Little/No Support Provided by MSRT	8	28.6%
Unknown	1	3.6%

Available and Willing to Help. Thirty-five percent of the high school mathematics teachers reported that the MSRT assigned to their school was available and willing to help.

- The MSRT has been invaluable with providing assistance with new programs such as PUMP algebra and any problems with computers, classes, classrooms, programming. It is good to have someone with the knowledge and skills to work with the school, central services, and organizations associated with the school.
- The MSRT is very willing to help and to supply anything we need for our projects.
- The MSRT has been very supportive for the math program.

Provided Access to Materials and Supplies. Assistance in finding and receiving materials was attributed to the MSRT by several teachers.

- Materials have been found that I would not have time to look for, nor would I know where to look.
- Getting material needed for instruction.

Acted as Liaison and Networking. The MSRT provided a link to other school officials and organizations. This is reported to be an effective means of communication.

- Without such liaison work we would be nowhere. We wish our MSRT could be here five days a week.
- Networking is easier using a person to communicate rather than mail or fax.

Little or No Support Provided. Seven teachers reported little or no support from their MSRT.

- I believe the MSRT has been involved more in grades 9-10 instruction than in grades 11-12.

- I believe more could have been accomplished if we had met with administration, math, science, and MUSI to coordinate efforts.
- MSRT is spread too thinly to be effective.
- Our MSRT has a very busy schedule because the person works with many different departments, and only has two days per week at our school. It would be nice if the MSRT could be at our school everyday.

High School Science MSRT Support

Seventeen high school science teachers gave 20 responses. Table 57 identifies the responses given, as well as the frequency and the percent of teachers responding in each category. Overall, 80 percent or 16 responses indicated support provided by the MSRT. The other 20 percent or 4 responses indicated little or no support provided by the MSRT.

Table 57. Support Provided by MSRT for High School Science

Support	Frequency	Percentage
Supportive to Teachers	7	35.0%
Provided Classroom Assistance	4	20.0%
Conducted Inservices/Training	2	10.0%
Miscellaneous Supports	3	15.0%
Unknown/Seldom See	3	15.0%
No Comments	1	5.0%

Supportive to Teachers. Teachers reported feeling supported and encouraged by the MSRT.

- Our MSRT was great. We want this person for another year.
- Excellent.
- The support has been excellent.
- The MSRT is working hard with the science teachers and has been very helpful.

Provided Classroom Assistance. High school science teachers reported impact in classroom assistance. The MSRT also provided technological assistance and help during labs.

- She has helped me on my labs —set up, assisting students, and so on.
- MSRT teacher has really helped my students understand the graphing calculator.
- The MSRT has encourage me to move towards a project based approach and provided assistance during and outside of class.

Summary

The Milwaukee Public Schools began the Milwaukee Urban Systemic Initiative (MUSI) in mathematics and science in 1996. Fifty-two schools were selected as the First Wave MUSI schools. In November 1996, elementary, middle, and high school teachers of mathematics and science in the First Wave MUSI Schools were surveyed regarding mathematics and science teaching and learning. A follow-up survey was given to elementary, middle, and high school teachers of mathematics and science in these same First Wave MUSI Schools two years later. This report contained the results of this initial (denoted as the pre-survey) and follow-up (denoted as post-survey) surveys.

Three different survey instruments were used: (a) elementary school mathematics and science, (b) middle school and high school mathematics, and (c) middle school and high school science. Across all three levels on the pre-survey or initial survey given in 1996, 670 teachers responded: 429 teachers responded to the elementary survey, 131 teachers responded to the middle and high school mathematics survey, and 110 teachers responded to the middle and high school science survey. On the post-survey or follow-up survey given in 1998, 486 teachers responded across all three levels: 283 teachers responded to the elementary survey, 113 teachers responded to the middle and high school mathematics survey, and 90 teachers responded to the middle and high school science survey.

Mathematics and Science Teaching and Learning

The results for the scaled-response items were presented within the following six categories: (1) Instructional Practices, Supplies, and Time; (2) Assessment Practices; (3) Technology; (4) Knowledge, Perceptions, and Beliefs; (5) Student Expectations and Policy; and (6) Professional Development and Collaboration. The following assertions were formed regarding mathematics and science teaching and learning when the initial and follow-up surveys of the First Wave MUSI Schools were compared.

Instructional Practices, Supplies, and Time

- Students at all levels were more likely to perform demonstrations once/twice a month or weekly during science instruction after the two years in the MUSI program.
- Fewer elementary teachers reported never using student-generated experiments on the post-survey compared to the pre-survey.
- Most elementary teachers reported using the MPS Science Kits, having available supplies to do hands-on science, and utilizing the MPS Science Content Standards Guide.
- Middle level teachers were more likely to report using the Science Curriculum Guide all of the time compared to high school teachers.
- Students at all levels used manipulatives. Elementary students were the most likely to use manipulatives at the end of two years in a MUSI school.
- Middle level teachers increased the amount of time students make conjectures and explore different methods to solve mathematics problems as reported on the post survey compared to the initial survey response.
- Informal learning environments were most often used once or twice a year by teachers at all levels as reported on the post-survey.
- After two years in MUSI, middle level teachers reported that fewer schools purchased none of the consumables for mathematics. High school teachers reported that more schools

purchased all the consumable materials needed for mathematics. After two years in the MUSI program, high school teachers reported an increase of 33 percent in the number of teachers indicating that their schools purchased all of the consumable materials for science.

- Elementary school and high school teachers reported increased satisfaction with the amount of time for mathematics instruction after two years in the MUSI program. At all levels, science teachers reported increases in their satisfaction with the amount of time for science instruction on the post-survey.
- Most (76 percent) students received more than 31 minutes of science instruction each week. Thirty-four percent of students received no additional science instruction beyond what was provided by their regular teacher. Nearly half of all student receive regular science instruction from a science specialist.

Assessment Practices

- At all levels, there was an increase from pre-survey to post-survey in the number of mathematics teachers reporting that they used open-ended questions for evaluative purposes on a daily basis. Half the number of elementary and middle level teachers that reported on the initial survey to never using open-ended questions to evaluate a students' learning of mathematics concepts changed the frequency of their use of open-ended questions
- Middle level science teachers reported increasing their use of open-ended questions once/twice per semester and once/twice a month on the post-survey.
- Fewer elementary and middle level teachers reported never using authentic performance tasks to evaluate students in mathematics. All levels of mathematics teachers reported an increase from pre-survey to post-survey in weekly use of authentic performance tasks.
- Fewer science high school teachers reported on the post-survey that they used authentic performance tasks weekly compared to the pre-survey.
- After two years in the MUSI program, middle school students were the most likely to be asked to prepare a portfolio of their mathematics work. Both middle and high school science teachers reported being less likely to use portfolios in the evaluation of a students science understanding on the post-survey compared to the pre-survey.

Technology

- At the end of two years in a MUSI school, high school teachers were the most likely to report never using computers for mathematics instruction. High school mathematics teachers were also the most likely to report easy access to computers within the schools.
- Both weekly and almost daily use of the computer in science instruction increased on the post-survey at the high school level. Fewer science teachers at all levels reported that computers were not available at all in their schools after two years as a MUSI school. The greatest increase in classroom availability of computers for science instruction was reported at the elementary level.
- Calculators were reported to be used more frequently on the post-survey by teachers at all levels. More teachers at all levels reported that calculators were available in the classroom on the post-survey than on the pre-survey.

Knowledge, Perceptions, and Beliefs

- After two years, middle school teachers reported the highest percentage of teachers indicating no knowledge of the NCTM standards. At all levels, teachers were "somewhat" more familiar with the NCTM standards as reported on the post-survey.
- Fewer teachers at all levels indicated not being familiar with the NRC science standards at all after participating in MUSI. Substantial increases were reported in the number of

elementary and middle level teachers indicating having some familiarity with the NRC standards.

- Teachers at all levels reported an increase in confidence in their ability to facilitate inquiry-based activities in mathematics.
- Greater confidence by elementary science teachers was reported in their ability to utilize background content knowledge in science. However, fewer middle level science teachers reported on the post-survey that they felt confident in this area.
- A substantial number of teachers at all levels reported lack of confidence in their ability to use computers as an integral part of mathematics instruction. Fewer teachers at the middle level reported feeling very strong in their ability to use computers as an integral part of science instruction after two years in a MUSI school.
- Nearly all teachers reported feeling confident in their understanding of mathematics concepts to be effective in teaching mathematics.
- Although most teachers reported feeling confident, nearly 11 percent of elementary teachers reported wondering if they have the necessary skills to teach mathematics.
- Elementary teachers were the most likely to disagree that students learn mathematics best in classes of students with similar ability. Elementary and middle level science teachers reported less agreement that students learn science best in classes of students with similar ability after two years of participation in MUSI. However, high school science teachers indicated increased agreement with similar ability classes being the best learning environment.
- Elementary mathematics teachers were the most likely to emphasize broad coverage of mathematical ideas on both the pre-survey and the post-survey.
- Elementary science teachers were most likely to indicate that they did not teach science as well as they taught most other subjects, even if they tried very hard.
- Middle level science teachers were the most likely to wonder if they had the necessary skills to teach science compared to other levels.

Student Expectations and Policy

- High school teachers were the most likely to report that few or none of their students could think mathematically to high levels on both the pre-survey and post-survey. Fewer high school and middle school teachers reported on the post-survey that they believed that "all" of their students could think to high mathematical levels.
- Fewer middle level science teachers reported on the post-survey that they believed most or all of their students can achieve a high level of scientific thinking. More high school science teachers reported believing that few of their students can think to high levels scientifically as reported on the post-survey.
- On the post-survey, science teachers at all levels indicated some increasing confidence that all students would be able to meet the new School Board graduation policy for science. Fewer high school science teachers reported strong support of the new graduation policy after two years of participation in MUSI.
- High school teachers in mathematics were most likely to disagree that under achievement by students was a result of ineffective teaching. Again, high school teachers were the most likely to agree that increased effort on the part of the teacher produces little effect on the student. Nearly 34 percent of high school teachers viewed a student's inadequate mathematics background as something that even good teaching could not overcome.
- As students get older, teachers express less confidence that an inadequate science background can be overcome by good science teaching.

- High school mathematics teachers remain the least likely to express support for the new School Board graduation policy in mathematics.
- High school mathematics teachers were the most likely to report an increase in the number of teachers on the post-survey compared to pre-survey that were involved in specific efforts to narrow achievement gaps in mathematics. Thirty-five percent more of high school science teachers reported that they were involved in efforts to narrow achievement gaps in the area of science.
- Middle level mathematics and science teachers were the most likely to report receiving assistance from the MSRT in their school. However, teachers at the elementary and high school levels reported a substantial number of teachers in both mathematics and science that did not feel assisted by the MSRT.

Impact of MUSI and Support Provided by MSRT

Teachers were asked to respond to open-ended questions that involved identifying the biggest impact MUSI has had on their mathematics or science instruction and to comment on the support provided to them and their schools by the MUSI Mathematics/Science Resource Teacher (MSRT). The responses were examined for themes at each level.

Elementary level (17 percent) and middle level (17 percent) mathematics teachers were more likely to indicated that there was improvement in their instructional method compared to high school mathematics teachers (9 percent). Twice the number of middle and high school mathematics teachers (20 percent for both) reported that the MSRT, serving as a mentor or support, was the biggest impact of MUSI compared to elementary teachers (10 percent). More mathematics teachers indicated that access to UWM classes impacted their instructional performance compared to science teachers. Nearly 40 percent of elementary level teachers reported that there was little or no impact from the MUSI program after serving for two years in a MUSI school. Middle level mathematics and science teachers (10 percent for each level) also reported that MUSI had little impact on their instruction. More than 20 percent of high school teachers (both mathematics and science) reported the same.

Teachers highlighted several areas in which MUSI had impacted their instruction after two years of their school's participation in the MUSI program. The major areas of impact were improvement in instructional methods, generation of ideas and suggestions, having the MSRT as a mentor or support, and increased understanding of proficiency standards. Despite the indication of strong impact of MUSI by the majority of teachers, a number of teachers reported that MUSI had little to no impact upon their teaching or their schools.

H school science (35 percent) and elementary level (21 percent) teachers were the most likely to report the MSRT as a support to teachers compared to middle level mathematics (13 percent) and science (18 percent) teachers. High school mathematics (36 percent) teachers were more likely to indicate that the availability or willingness of the MSRT to consult with them was the greatest support. Middle level teachers, both mathematics (14 percent) and science (15 percent), were the only teachers to report the helpful/willing attitude of the MSRT when initially approached to be the greatest source of support. High school science (20 percent) were the only teachers to report that classroom assistance was the most supportive activity of the MSRTs. However, a substantial percentage of teachers at all levels (elementary, 27 percent; middle, 16 percent; high school, 25 percent) reported that the MSRT provided little or no support to their teaching efforts. In fact, 15 percent of the high school science teachers reported not knowing or seldom seeing the MSRT during school hours.

The teachers highlighted several areas in which the MSRT provided support to the instructional needs of teachers. These supports included having the MSRT available and willing to consult, providing access to materials or supplies or being able to procure funds when needed, and being a resource for ideas or suggestions. Despite a substantial number of teachers reporting that the MSRT provided some means of added support within their school, a number of teachers reported that they found the MSRT provided little or no support within their school.

Appendix A

First Wave Schools of the Milwaukee Urban Systemic Initiative (MUSI)

Anna F. Doerfler Elementary School
Auer Avenue Elementary School
Clarke Street Elementary School
Clement J. Zablocki Elementary School
Martin Luther King, Jr. Elementary School
Eighty-first Street Elementary School
Fifty-third Street Elementary School
Franklin Pierce Elementary School
Garfield Avenue Elementary School
Gilbert Stuart Elementary School
Grantosa Drive Elementary School
Green Bay Avenue Elementary School
Henry David Thoreau Elementary School
Lloyd Street Elementary School
McNair Academy Elementary School
Milwaukee Spanish Immersion School
Morgandale Elementary School
Nathaniel Hawthorne
Neeskara Elementary School
River Trail Elementary School
Robert M. LaFollette Elementary School
Sixty-fifth Street Elementary School
Urban Waldorf Elementary School
U.S. Grant Elementary School
Walt Whitman Elementary School
William Cullen Bryant Elementary School
William T. Sherman Elementary School
Cass Street (K-8) School
Fernwood (K-8) School
Hartford Avenue (K-8) School

Gustav A. Fritsche Middle School
Christopher Lathom Sholes Middle School
Thomas A. Edison Middle School
Daniel Webster Middle School
Milwaukee School of Languages
Steuben Middle School
Jackie Robinson Middle School
Lavarnway Boys/Girls Club
Lincoln School of the Arts
Roosevelt School of the Arts
John Burroughs Middle School
Sarah Scott Middle School
Malcolm X Academy Middle School
Andrew Douglas Community Academy
Milwaukee Village Middle School
Moltke Academy Middle School
Grand Avenue School
South Division High School
Solomon Juneau High School
Casimir Pulaski High School
Harold S. Vincent High School
Washington High School

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Appendix B

Survey Instruments

Elementary Mathematics and Science

Middle and High School Mathematics

Middle and High School Science

MUSI Elementary School Survey Mathematics and Science

1. At what grade level do you teach? a. K–2 b. 3–6 c. Other

Part I. MATHEMATICS

2. How many total minutes of mathematics instruction do your students receive each week?
   a. 0–60 b. 61–120 c. 121–180 d. 181–240 e. 241 or more

For items 3–18, respond as follows:

a. Strongly Agree b. Agree c. Undecided d. Disagree e. Strongly Disagree

Provide your opinion or perception about each of the following statements.

3. I feel supported by colleagues to try out new ideas in teaching mathematics.
4. I understand mathematics concepts well enough to be effective in teaching mathematics.
5. I have adequate class time for students to learn mathematics.
6. Students need to master arithmetic computation before going on to algebra.
7. If students are underachieving in math, it is most likely due to ineffective math teaching.
8. Students learn mathematics best in classes of students of similar abilities.
9. Even if I try very hard, I do not teach mathematics as well as I do most other subjects.
10. It is important to emphasize broad coverage of many mathematical ideas.
11. Increased effort in math teaching produces little change in some students' math achievement.
12. Teachers in this school regularly share ideas and materials about mathematics.
13. I wonder if I have the necessary skills to teach mathematics.
14. I have been involved in specific efforts to narrow student achievement gaps in mathematics between ethnic, gender, and income groups.
15. I have many opportunities to learn new things about teaching mathematics in my present job.
16. The inadequacy of a student's mathematics background can be overcome by good teaching.
17. The MUSI Mathematics/Science Resource Teacher (MSRT) assigned to my school has assisted me in improving my mathematics instruction.
18. Being a MUSI school for the past 2 years has allowed us to focus on and improve the mathematics program in our school.

For items 19–21, respond as follows: a. All b. Most c. Some d. Few e. None

19. How many of the needed consumable supplies (e.g. paper, toothpicks, tracing paper) are regularly purchased by your school for student use in mathematics?
20. How many of the needed non-consumable mathematics supplies (e.g. manipulatives, rulers) are available in sufficient quantity for student use?
21. Based upon your current class of students, how many students can learn to think and work mathematically to high levels?

For items 22–27, respond as follows:

a. Almost Daily b. Weekly c. Once or Twice a Month d. Once or Twice a Semester e. Never

22. How often do students work together in pairs or small groups on math problems or tasks?
23. How often do students use manipulative materials to help them understand mathematical concepts?

24. How often do students make conjectures and explore different methods to solve a mathematics problem?
25. How often do students use computers for mathematics?
26. How often do students use calculators for mathematics?
27. How often do you evaluate student' learning of mathematics by having them respond in writing to open-ended questions (e.g. writing in journals or as part of tasks and assignments)?

For items 28–30, respond as follows: a. Very Strong b. Strong c. Adequate d. Weak e. Very Weak

To what degree are each of the following a strength or weakness in your mathematics teaching?

28. Facilitating inquiry-based activities in mathematics.
29. Using computers as an integral part of mathematics instruction.
30. Regularly integrating calculators into mathematics lessons as a learning tool.

For items 31–32, respond as follows:

a. Available within the classroom
b. Available within the school and easy to access
c. Available in the school but difficult to access
d. Not available for mathematics instruction

31. How available are computers for mathematics instruction?
32. How available are calculators for mathematics instruction?
33. How often did or will your students visit an informal learning environment (e.g. zoo, museum, nature center, park, business) as part of your math program during the 1997-98 school year?
    a. Never b. 1–2 times c. 3–5 times d. 6–8 times e. 9 or more time
34. How familiar are you with the national mathematics standards developed by the National Council of Teachers of Mathematics (NCTM)?
    a. Very b. Somewhat c. Heard of, but don't know much about them d. Not at all
35. Do you evaluate your students' mathematics learning by having them prepare portfolios that include student reflection on their learning and samples of student work?
    a. Yes b. No
36. How often do you evaluate students' mathematics learning with authentic performance tasks that require them to solve realistic problems and support their solutions by explaining their reasoning?
    a. Weekly b. Twice a month c. Once a month d. Rarely e. Never
37. From September 1996 through August 1997, what is the total amount of time you spent on staff development in mathematics (e.g. conferences, inservices, workshops, courses)?
    a. 0 hours b. 1–5 hours c. 6–15 hours d. 16–35 hourse. 36 or more hours
38. From September 1997 through April 1998, what is the total amount of time you spent on staff development in mathematics (e.g. conferences, inservices, workshops, courses)?
    a. 0 hours b. 1–5 hours c. 6–15 hours d. 16–35 hourse. 36 or more hours

The new School Board Policy states: Students will demonstrate mastery of mathematical proficiency equivalent to three years of study beyond Algebra One. Students will be expected to show proficiency in first year algebra by the end of the eighth grade.

39. How many MPS students will be able to achieve this goal?
    a. All b. Most c. Some d. Few e. None
40. Indicate your level of support for the new School Board Policy for mathematics.
    a. Very Strong b. Strong c. Neutral d. Oppose e. Strongly Oppose

Part II. SCIENCE

41. How many total minutes of science instruction do your students receive each week?
    a. 0–60 b. 61–120 c. 121–180 d. 181–240 e. 241 or more
42. Does a science specialist provide regular instruction in science to your students?
    a. Yes b. No

For items 43–61, respond as follows:
a. Strongly Agree b. Agree c. Undecided d. Disagree e. Strongly Disagree

Provide your opinion or perception about each of the following statements.

43. The MPS Science Kits are an essential part of my science program.
44. I am able to get the necessary consumable supplies and equipment to do hands-on science using the MPS Science Kits or materials accessible within my school.
45. I utilize the Science Content Standards and Process Outcomes guide developed by MPS in planning and implementing my science program.
46. The MUSI Mathematics/Science Resource Teacher (MSRT) assigned to my school has assisted me in improving my science instruction.
47. Being a MUSI school for the past 2 years has allowed us to focus on and improve the science program in our school.

Provide your opinion or perception about each of the following statements.

48. I feel supported by colleagues to try out new ideas in teaching science.
49. I understand science concepts well enough to be effective in teaching science.
50. I have adequate class time for students to learn science.
51. It is important for students to learn basic scientific terms and formulas before learning underlying concepts and principles.
52. If students are underachieving in science, it is most likely due to ineffective science teaching.
53. Students learn science best in classes of students of similar abilities.
54. Even if I try very hard, I do not teach science as well as I do most other subjects.
55. It is important to emphasize broad coverage of many scientific concepts and principles.
56. Increased effort in science teaching produces little change in some students' science achievement.
57. Teachers in this school regularly share ideas and materials about science.
58. I wonder if I have the necessary skills to teach science.
59. I have been involved in specific efforts to narrow achievement gaps in science between ethnic, gender, and income groups.
60. I have many opportunities to learn new things about teaching science in my present job.
61. The inadequacy of a student's science background can be overcome by good teaching.

For items 62–65, respond as follows:
a. Almost Daily b. Weekly c. Once or Twice a Month d. Once or Twice a Semester e. Never

62. How often do students conduct student-generated experiments with outcomes unknown to them and in which students control variables?
63. How often do students perform demonstrations with materials in which they follow a prescribed set of procedures in order to observe a scientific phenomenon?
64. How often do students use computers for science?

65. How often do you evaluate students' science learning by having them respond in writing to open-ended questions with more than one right answer (e.g. journal writing or as part of tasks)?

For items 66–68, respond as follows: a. Very Strong b. Strong c. Adequate d. Weak e. Very Weak

To what degree are each of the following a strength or weakness in your science teaching?

66. Background content knowledge of science.
67. Facilitating inquiry-based activities in science.
68. Using computers as an integral part of science instruction.
69. How available are computers for science instruction?
    a. Available within the classroom
    b. Available within the school and easy to access
    c. Available in the school but difficult to access
    d. Not available for science instruction
70. How often did your students visit an informal learning environment (e.g. zoo, museum, nature center, park, business) as part of your science program during the 1997-98 school year?
    a. Never b. 1–2 times c. 3–5 times d. 6–8 times e. 9 or more times
71. Based upon your current class of students, how many students can learn to think and work scientifically to high levels?
    a. All b. Most c. Some d. Few e. None
72. Do you evaluate your students' science learning by having them prepare portfolios that include student reflection on their learning and samples of student work?
    a. Yes b. No
73. How often do you evaluate students' science learning with authentic performance tasks that require students to use materials or equipment, collect and organize data, and draw conclusions?
    a. Weekly b. Twice a Month c. Once a Month d. Rarely e. Never
74. How familiar are you with the national science standards developed by the National Research Council (NRC)?
    a. Very b. Somewhat c. Heard of, but don't know much about them d. Not at all
75. From September 1996 through August 1997, what is the total amount of time you spent on staff development in science (e.g. conferences, inservices, workshops, courses)?
    a. 0 hours b. 1–5 hours c. 6–15 hours d. 16–35 hourse. 36 or more hours
76. From September 1997 through April 1998, what is the total amount of time you spent on staff development in science (e.g. conferences, inservices, workshops, courses)?
    a. 0 hours b. 1–5 hours c. 6–15 hours d. 16–35 hourse. 36 or more hours

The new School Board Policy states: Students will demonstrate a high level of proficiency in science, equivalent to three years of high school study to include the physical, biological, and chemical sciences. Students will demonstrate an understanding of scientific inquiry and its application to real life situations.

77. How many MPS students will be able to achieve this goal?
    a. All b. Most c. Some d. Few e. None
78. Indicate your level of support for the new School Board Policy for science.
    a. Very Strong b. Strong c. Neutral d. Oppose e. Strongly Oppose

Part III. Write In Area Questions (Use Spaces on the Answer Sheet)

Area 1. What is the biggest impact MUSI has had on your mathematics instruction?

Area 2. What is the biggest impact MUSI has had on your science instruction?

Areas 3&4. Comment on the support provided to you and your school by the MUSI Mathematics and Science Resource Teacher (MSRT) assigned to your school.

MUSI Middle and High School Survey Mathematics

1. Important: Survey identification:
   If this is a *math* survey, "bubble" 1-a. If this is a *science* survey, "bubble" 1-b
2. At what grade level do you teach (majority of time)? a. 6–8 b. 9–10 c. 11-12 d. Other

For items 3–18, respond as follows: a. Strongly Agree b. Agree c. Undecided d. Disagree e. Strongly Disagree

Provide your opinion or perception about each of the following statements.

3. I feel supported by colleagues to try out new ideas in teaching mathematics.
4. I understand mathematics concepts well enough to be effective in teaching mathematics.
5. I have adequate class time for students to learn mathematics.
6. Students need to master arithmetic computation before going on to algebra.
7. If students are underachieving in math, it is most likely due to ineffective math teaching.
8. Students learn mathematics best in classes of students of similar abilities.
9. Even if I try very hard, I do not teach mathematics as well as I do most other subjects.
10. It is important to emphasize broad coverage of many mathematical ideas.
11. Increased effort in mathematics teaching produces little change in some students' mathematics achievement.
12. Teachers in this school regularly share ideas and materials about mathematics.
13. I wonder if I have the necessary skills to teach mathematics.
14. I have been involved in specific efforts to narrow student achievement gaps in mathematics between ethnic, gender, and income groups.
15. I have many opportunities to learn new things about teaching mathematics in my present job.
16. The inadequacy of a student's mathematics background can be overcome by good teaching.
17. The MUSI Mathematics/Science Resource Teacher (MSRT) assigned to my school has assisted me in improving my mathematics instruction.
18. Being a MUSI school for the past 2 years has allowed us to focus on and improve the mathematics program in our school.

For items 19–21, respond as follows: a. All b. Most c. Some d. Few e. None

19. How many of the needed consumable supplies (e.g. paper, toothpicks, tracing paper) are regularly purchased by your school for student use in mathematics?
20. How many of the needed non-consumable mathematics supplies (e.g. manipulatives, rulers) are available in sufficient quantity for student use?
21. Based upon your current class of students, how many students can learn to think and work mathematically to high levels?

For items 22–27, respond as follows:
a. Almost Daily b. Weekly c. Once or Twice a Month d. Once or Twice a Semester e. Never

22. How often do students work together in pairs or small groups on math problems or tasks?
23. How often do students use manipulative materials to help them understand math concepts?
24. How often do students make conjectures and explore different methods to solve a mathematics problem?
25. How often do students use computers for mathematics?

26. How often do students use calculators for mathematics?
27. How often do you evaluate student' learning of mathematics by having them respond in writing to open-ended questions (e.g. writing in journals or as part of tasks and assignments)?

For items 28–31, respond as follows: a. Very Strong b. Strong c. Adequate d. Weak e. Very Weak

To what degree are each of the following a strength or weakness in your mathematics teaching?

28. Background content knowledge of mathematics.
29. Facilitating inquiry-based activities in mathematics.
30. Using computers as an integral part of mathematics instruction.
31. Regularly integrating calculators into mathematics lessons as a learning tool.

For items 32–33, respond as follows:

a. Available within the classroom
b. Available within the school and easy to access
c. Available in the school but difficult to access
d. Not available for mathematics instruction

32. How available are computers for mathematics instruction?
33. How available are calculators for mathematics instruction?
34. How often did or will your students visit an informal learning environment (e.g. zoo, museum, nature center, park, business) as part of your math program during the 1997-98 school year?
    a. Never b. 1–2 times c. 3–5 times d. 6–8 times e. 9 or more times
35. Do you evaluate your students' mathematics learning by having them prepare portfolios that include student reflection on their learning and samples of student work?
    a. Yes b. No
36. How often do you evaluate students' mathematics learning with authentic performance tasks that require them to solve realistic problems and support the solutions by explaining their reasoning?
    a. Weekly b. Twice a month c. Once a month d. Rarely e. Never
37. How familiar are you with the national mathematics standards developed by the National Council of Teachers of Mathematics (NCTM)?
    a. Very b. Somewhat c. Heard of, but don't know much about them d. Not at all
38. From September 1996 through August 1997, what is the total amount of time you spent on staff development in mathematics (e.g. conferences, inservices, workshops, courses)?
    a. 0 hours b. 1–5 hours c. 6–15 hours d. 16–35 hours e. 36 or more hours
39. From September 1997 through April 1998, what is the total amount of time you spent on staff development in mathematics (e.g. conferences, inservices, workshops, courses)?
    a. 0 hours b. 1–5 hours c. 6–15 hours d. 16–35 hours e. 36 or more hours

The new School Board Policy states: Students will demonstrate mastery of mathematical proficiency equivalent to three years of study beyond Algebra One. Students will be expected to show proficiency in first year algebra by the end of the eighth grade.

40. How many MPS students will be able to achieve this goal?
    a. All b. Most c. Some d. Few e. None
41. Indicate your level of support for the new School Board Policy for mathematics.
    a. Very Strong b. Strong c. Neutral d. Oppose e. Strongly Oppose

Write In Area Questions (Use Space on Answer Sheet)

Areas 1&2. What is the biggest impact MUSI has had on your mathematics instruction?

Areas 3&4. Comment on the support provided to you and your school by the MUSI Mathematics/Science Resource Teacher (MSRT) assigned to your school.

MUSI Middle and High School Survey Science

1. Important: Survey identification:
   If this is a *math* survey, "bubble" 1-a. If this is a *science* survey, "bubble" 1-b
2. At what grade level do you teach (majority of time)? a. 6–8 b. 9–10 c. 11-12 d. Other

For items 3–19, respond as follows: a. Strongly Agree b. Agree c. Undecided d. Disagree e. Strongly Disagree

Provide your opinion or perception about each of the following statements.

3. I feel supported by colleagues to try out new ideas in teaching science.
4. I understand science concepts well enough to be effective in teaching science.
5. I have adequate class time for students to learn science.
6. It is important for students to learn basic scientific terms and formulas before learning underlying concepts and principles.
7. If students are underachieving in science, it is most likely due to ineffective science teaching.
8. Students learn science best in classes of students of similar abilities.
9. Even if I try very hard, I do not teach science as well as I do most other subjects.
10. It is important to emphasize broad coverage of many scientific concepts and principles.
11. Increased effort in science teaching produces little change in some students' science achievement.
12. Teachers in this school regularly share ideas and materials about science.
13. I wonder if I have the necessary skills to teach science.
14. It is important to integrate science disciplines (e.g. life, earth, and physical sciences).
15. I have been involved in specific efforts to narrow achievement gaps in science between ethnic, gender, and income groups.
16. I have many opportunities to learn new things about teaching science in my present job.
17. The inadequacy of a student's science background can be overcome by good teaching.
18. The MUSI Mathematics/Science Resource Teacher (MSRT) assigned to my school has assisted me in improving my science instruction.
19. Being a MUSI school for the past 2 years has allowed us to focus on and improve the science program in our school.

For items 20–22, respond as follows: a. All b. Most c. Some d. Few e. None

20. How many of the needed consumable science supplies (e.g. chemicals, food products) are regularly purchased by your school for student use?
21. How many of the needed non-consumable science supplies (e.g. balances, thermometers) are available in sufficient quantity for student use?
22. Based upon your current class of students, how many students can learn to think and work scientifically to high levels?

For items 23–26, respond as follows:
a. Almost Daily b. Weekly c. Once or Twice a Month d. Once or Twice a Semester e. Never

23. How often do students conduct student-generated experiments with outcomes unknown to them and in which students control variables?
24. How often do students perform demonstrations with materials in which they follow a prescribed set of procedures in order to observe a scientific phenomenon?

25. How often do students use computers for science?
26. How often do you evaluate students' learning of science by having them respond in writing to open-ended questions with more than one right answer (e.g. journal writing or as part of tasks)?

For items 27–29 respond as follows: a. Very Strong b. Strong c. Adequate d. Weak e. Very Weak

To what degree are each of the following a strength or weakness in your science teaching?

27. Background content knowledge of science.
28. Facilitating inquiry-based activities in science.
29. Using computers as an integral part of science instruction.
30. How available are computers for science instruction?
    a. Available within the classroom
    b. Available within the school and easy to access
    c. Available in the school but difficult to access
    d. Not available for science instruction
31. How often did or will your students visit an informal learning environment (e.g. zoo, museum, nature center, park, business) as part of your science program during the 1997-98 school year?
    a. Never b. 1–2 times c. 3–5 times d. 6–8 times e. 9 or more times
32. Do you evaluate your students' science learning by having them prepare portfolios that include student reflection on their learning and samples of student work?
    a. Yes b. No
33. How often do you evaluate students' science learning with authentic performance tasks that require students to use materials or equipment, collect and organize data, and draw conclusions?
    a. Weekly b. Twice a Month c. Once a Month d. Rarely e. Never
34. I utilize the Middle Level Science, Integrated Ninth Grade Science, or Biology Curriculum Guide developed by MPS in planning and implementing my science program.
    a. All the time b. Sometime c. Not at all d. Not applicable, I teach chemistry or physics
35. How familiar are you with the national science standards developed by the National Research Council (NRC)?
    a. Very b. Somewhat c. Heard of, but don't know much about them d. Not at all
36. From September 1996 through August 1997, what is the total amount of time you spent on staff development in science (e.g. conferences, inservices, workshops, courses)?
    a. 0 hours b. 1–5 hours c. 6–15 hours d. 16–35 hours e. 36 or more hours
37. From September 1997 through April 1998, what is the total amount of time you spent on staff development in science (e.g. conferences, inservices, workshops, courses)?
    a. 0 hours b. 1–5 hours c. 6–15 hours d. 16–35 hours e. 36 or more hours

The new School Board Policy states: Students will demonstrate a high level of proficiency in science, equivalent to three years of high school study to include the physical, biological, and chemical sciences. Students will demonstrate an understanding of scientific inquiry and its application to real life situations.

38. How many MPS students will be able to achieve this goal?
    a. All b. Most c. Some d. Few e. None
39. Indicate your level of support for the new School Board Policy for science.
    a. Very Strong b. Strong c. Neutral d. Oppose e. Strongly Oppose

Write In Area Questions (Use Space on the Answer Sheet)

Areas 1&2. What is the biggest impact MUSI has had on your science instruction?

Areas 3&4. Comment on the support provided to you and your school by the MUSI Mathematics/Science Resource Teacher (MSRT) assigned to your school.

U.S. DEPARTMENT OF EDUCATION
Office of Educational Research and Improvement (OERI)
Educational Resources Information Center (ERIC)

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