



TITLE II, PART B

MATH AND SCIENCE PARTNERSHIPS PROGRAM

ANNUAL REPORT

FISCAL YEAR 2004-2005

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Introduction

The Pennsylvania Department of Education (PDE) has produced this annual report to provide an overall evaluation of the Math and Science Partnerships (MSP) Program in the Commonwealth of Pennsylvania. The intent of the report is to describe and evaluate the current status of the programs, and to summarize the cumulative impact of the programs based on the combined contributions across the individual programs. Each of the seven funded programs completed the *Project Profile*, *Project Narrative*, and *Project Evaluation Report* as requested by the United States Department of Education (USDE) Mathematics-Science Partnerships. From those profiles, narratives, and project evaluations, PDE began to compile data across all of the programs to develop this annual report to be shared with USDE.

In terms of organization, this report includes the data submitted by the programs and copies of the seven individual *Project Profiles*, *Project Narratives*, as well as a summary of each of the *Project Evaluation Reports*. The summary tables included in the annual report present the results of a content analysis of the program components to describe some of the commonalities across the seven programs as well as the activities and evaluation methods that are present throughout the programs. The tables also describe program implementation and trends in math and science achievement.

Project Profiles

The common goals that seemed to be shared by most of the programs were as follows.

1. To increase K-12 students' knowledge of mathematics and science.
2. To increase teachers' content knowledge in science or mathematics.
3. To provide high quality professional development that would lead to improved instructional practices in the classroom.

The general characteristics of those students involved in program activities across all seven projects vary somewhat in terms of school profile data.

1. There are 113 schools being served by the MSP programs.
2. There are 1,520 teachers being served by the program.
3. There are about 48,700 students being served by the MSP programs.
4. There are 91 faculty members from Institutions of Higher Education participating in the program.

There were common themes across the programs in terms of professional development and these varied considerably in terms of frequency and duration.

1. Summer Institutes – on average summer institutes occur over a 10-day period and usually last a total of 60 hours.
2. On-site professional learning experiences.
3. Study groups.
4. Others – such as weekend retreats and seminars.

The outcome of teachers who increased their general knowledge in math or science as a result of participating in a MSP program is good.

1. About 80% of teachers increased their content knowledge in Math on pre/post-test teacher content measures in math.
2. About 70% of teachers increased their content knowledge in Science on pre/post-test teacher content measures in science.

Most projects provided information on the percent of students' proficient and advanced scores on standardized math assessment tools. In addition, change scores are provided to illustrate the level of impact the MSP programs have effected on math student achievement.

1. As evidenced by the positive change scores across all grade categories, a majority of the MSP programs are having a positive effect on math student achievement. It is important to note that the greatest effects are occurring at the elementary school level and more modest effects are occurring at the middle school level.
2. At the same time, some projects have not reported student achievement data for mathematics and, until data are gathered, it is difficult to assess overall impact on a statewide basis.

The projects also provided information on student performance on standardized science assessment tools. Again, change scores are provided to illustrate the level of impact the MSP programs have effected on science student achievement.

1. As evidenced by the positive change scores for the elementary and middle school levels, some MSP programs are having a positive effect on science student achievement. It is important to note the greatest effects are occurring at the high school level and more modest effects are occurring at the middle school level.
2. As with data related to student progress in mathematics, some projects have not reported student achievement data for science and, until data are provided, it is difficult to determine program impact on a statewide basis.

Project Narratives

This year, the Pennsylvania Department of Education (PDE) is submitting copies of the *Project Narratives* along with the *Project Profiles* that were completed by each of the seven programs. The narrative allows each of the individual programs the opportunity to provide additional information about their programs. This information is extremely useful in understanding program operations and implementation as well as the actual content being addressed in an effort to improve the teaching and learning process. The Project Narratives are organized into the following sections: (1) Cover Sheet; (2) Executive Summary, including project design and interventions as well as major accomplishments; (3) Project Performance Summary; and (4) Supplemental Information.

In terms of program design and interventions, the professional development activities undertaken vary across the projects, given the differing needs of the individual districts and schools they serve. The projects and programs also differed in terms of their activities, approaches, and content. With the exception of the general goals of improving teacher content knowledge and student achievement and the provision of high quality professional development, an overall content analysis of the project narratives yielded few common themes. The narratives do provide greater insight into program activities and how the various professional development components are functioning to attain project goals and objectives.

With respect to major accomplishments, the projects took different approaches to addressing this section. Some simply provided a statement of goals and objectives and provided a summary of whatever data existed to support the attainment of the goals/objectives. Other projects inserted information from their evaluation report in this section. Others saw this as an opportunity to tie the implementation of program components to the description of program design and interventions. As the individual projects approached this section in different ways, there is little common ground to adequately describe shared features, findings, etc.

With respect to project performance, as a general summary or conclusion, the data provided in the narratives suggest that the quality of the math and science experiences

provided to students has increased dramatically as a result of the professional development interaction with university faculty, and the availability of materials, equipment, and technology.

Project Evaluation Reports

In October, 2005, the United States Department of Education (USDE) issued guidelines regarding the expectations for the evaluations of all MSP Programs. These expectations deal with the need for MSP projects to conduct more rigorous evaluations focusing on the two primary goals of the MSP program; namely to increase (1) teacher content knowledge and (2) student achievement. More specifically, it is expected that all MSP projects will: (1) utilize an evaluation design that is either a randomized control trial or matched-group comparison design; (2) have adequate numbers of teachers and students in the experimental and control groups to provide sufficient power for the statistical tests of significance that are to be employed; (3) utilize standardized, rather than project-developed, measures of teacher content knowledge and student achievement; and (4) use regression-based and linear models as data analysis tools for estimating project impact.

To help the seven projects in the Commonwealth of Pennsylvania meet these guidelines and expectations, several activities were initiated. The state MSP coordinator and independent evaluator met with USDE officials to review the guidelines/expectations. After reviewing the project-level evaluation plans, the state coordinator and evaluator held a preliminary meeting with the seven Pennsylvania projects to provide an overview of the guidelines/expectations. The meetings with each individual project were held to (1) review their current status with respect to their evaluation efforts and (2) provide them with concrete suggestions of the ways in which they can improve the rigor of their evaluation approaches; these meetings took place in March 2006.

To take advantage of the expertise and knowledge of the individual project evaluators, and to help create a sense of camaraderie among the evaluators through the sharing of ideas and approaches to MSP evaluations, an MSP Evaluators Meeting was held at the PDE offices on July 6, 2006. There were three panel discussions featuring short presentations by the MSP evaluators: measurement and instrumentation, research and evaluation designs, and data analysis techniques. Each project provided information about the current status of their evaluations with respect to teacher content knowledge and student achievement and a summary of these self-reports follow.

Teacher Content Knowledge

- All of the projects will be using a Pre-Test/Post-Test Matched Comparison-Group Design; the number of teachers in the “treatment” or “experimental” group and control group will vary by project given the size of the program and scope of work.
- More than half of the projects will be using standardized instruments for assessing teacher content gains in math and/or science while the other projects will be using

locally developed instruments; the standardized instruments being utilized include the Survey of Enacted Curriculum, Praxis exam scores, Learning Mathematics for Teachers (LMT), and measures developed by Horizon.

- The projects will be using a variety of data analysis tools including multivariate analysis of variance, repeated paired t-tests, and regression techniques.

Student Achievement

- As with the designs being utilized for teacher content knowledge, most all of the projects will be using some variation of a Pre-Test/Post-Test Matched Comparison-Group Design to examine gains in student achievement; again, the number of students in the treatment and control groups will vary by project given the size of the program.
- Most all of the projects will be employing standardized instruments for measuring student achievement in math and/or science; these include PSSA, TerraNova, Science Process Assessment, Promise, and PASS (Partnership for the Assessment of Standard-Based Science).
- In terms of data analysis, the projects will be using a variety of tools such as multivariate analysis of variance, analysis of covariance, repeated paired t-tests, and regression techniques including linear hierarchical models.

It is anticipated that the seven MSP projects in Pennsylvania will continue to make substantial progress in implementing more rigorous evaluations of program impact. Every project evaluator indicated that:

The evaluation approach being used by their project will provide valid estimates of program effects and enable the evaluators to determine if the MSP project resulted in increases in (1) the math and/or science content knowledge of participating teachers and (2) student achievement in math and/or science.

Table 1: Math and Science Partnership Program General Information

Participation Criteria

Project	Budget	A&S Faculty	Research Design	Schools	Teachers	Students
Scranton S.D.	682,212	5	Experimental	Based on Need	Based on need.	Based on Need
Aliquippa S.D. - Allegheny IU 3	603,008	48	Other	Based on Need	Administrative Selection/ Leadership Teams	Participating Teachers
Chester County IU 24	649,339	5	Quasi-Experimental, no control and comparison group, pre-post test of teachers and students.	Based on Need	Volunteer/ Administrative Selection	Students of teachers in project.
Central Susquehanna IU 16	396,964	12	Quasi-Experimental	Based on Need	Volunteer/ Administrative Selection	Random Assignment
Appalachia IU 8	700,643	7	Quasi-Experimental/ Surveys, Observations, Interviews	Based on Need	Volunteer	Participating Teachers
Allentown S.D.	337,863	5	Quasi-Experimental	Volunteer	Volunteer	Participating Teachers
Philadelphia S.D.	708,424	9	Quasi-Experimental/ Formative/ Summative	Based on Need	Volunteer/ Need	Based on Need

The Math and Science Partnership Program is based on providing funding to underachieving school districts and intermediate units to increase both student achievement and teacher content knowledge in those areas.

- The total number of Arts and Science faculty involved with the MSP programs is 91.
- Five out of the seven MSP programs (71%) are using an experimental or quasi-experimental design. In addition, some of the programs are also using other research methods that may include comparison groups, pre-post test observation, and surveys.
- In general, participation by schools in each of the districts and intermediate units was based on need. Six out of the seven (86 %) MSP programs included teachers who either volunteered or were selected by the principal or other administrative staff.

Table 2: Math and Science Partnership Profile Professional Development Data

Project	Summer Institutes		Distance		On-Site		Study Group		Other	
	Duration	Frequency	Duration	Frequency	Duration	Frequency	Duration	Frequency	Duration	Frequency
Scranton S.D.	5 weeks	Yearly	NA	NA	25 wks	Yearly	NA	NA	Off-site/ 6 hrs.	1
Aliquippa S.D. - Allegheny IU 3	5 days	4	NA	NA	24 hrs.	Year	2 full days/ (8) 1/2 days	Year	Follow-up (5) 1/2 days / 24 hours	Year
Chester County IU 24	60 hrs.	10 days	6 hrs.	2	NA	NA	30 hours	10 evenings	Listserve	Continuous
Central Susquehanna IU 16	45 hrs.	1	NA	NA	56 hrs.	7	NA	NA	16 hrs.	7
Appalachia IU 8	60 hrs.	10 days	NA	NA	24 hrs.	4 days	NA	NA	18 hrs.	9 day
Allentown S.D.	10 days	3	NA	NA	NA	NA	Ongoing	Year	Retreat/ 3 days	Year
Philadelphia S.D.	24 hrs.	3-6 days	NA	NA	NA	NA	NA	NA	3 sess.	3 day

There were common themes across the programs in terms of professional development and these varied considerably in terms of frequency and duration.

- Summer Institutes – on average, summer institutes occur over a 10-day period and usually last a total of 60 hours.
- On-site professional learning experiences.
- Study groups.
- Others – such as weekend retreats, seminars, and list serves.

Table 3: Math and Science Partnership Program Evaluation Tools

Project	Content Knowledge	Math Assessment	Science Assessment	Other	Class Observation	Other
Scranton S.D.	Pre-Post Test	PSSA	Terra Nova	Report Cards	NA	NA
Aliquippa S.D. - Allegheny IU 3	Learning Mathematics for Teaching	PSSA	PROM/SE Science	NA	Adapted from Horizon Research	Administrator Survey, Case Studies, Documentation of implementation
Chester County IU 24	Pre-Post Test based on science, math, & tech.	Locally Developed	Locally Developed	Self-assessment, teacher portfolio's, surveys	NA	Project designed student pre and post tests
Central Susquehanna IU 16	Pre-Post Test (Susquehanna Univ.)	PSSA	Partnership for the Assessment of Standards based Science (West Ed.)	Survey of Enacted Curriculum	Modified Local Systemic Change Classroom Observation (Horizon Research).	Interviews, focus groups, surveys, etc.
Appalachia IU 8	Criterion-referenced test created by SFU faculty, self-reports, observations	PSSA	ITBS & Science Process Assessment Grades 3-8	Survey of Enacted Curriculum	Adapted from Horizon Research	Interviews, focus groups, surveys, etc.
Allentown S.D.	Multiple Choice Test	PSSA	FOSS and Science Notebooks	Focus groups, surveys, materials & process audits	Reformed Teacher Observation Protocol	Peer sharing audits & survey
Philadelphia S.D.	Pre-Post Test	NA	Terra Nova	NA	NA	Surveys and focus groups.

There were a number of data collection efforts being conducted across the programs to examine the implementation processes and outcomes and the degree of evaluation sophistication varies across the projects.

- Four out of the seven (or 57%) MSP programs use pre/post-test surveys to assess Teacher Content Knowledge.
- The Pennsylvania System of State Assessment (PSSA) was used to assess 57% of the MSP programs – Math student achievement component.
- There is no common evaluation tool for the assessment of the student achievement science component of the MSP programs.
- Three of the seven (or 43%) MSP Programs use a classroom observation tool adapted from Horizon Research Incorporated.

Table 4: Math and Science Partnership Program Teacher Data

Participation by Area

Project	Served	Highly Qualified (HQ)	Not HQ	Certifications	General	Math	Science	Other
Scranton S.D.	120	30	90	10	120	0	0	0
Aliquippa S.D. - Allegheny IU 3	560	559	1	559	395	98	67	0
Chester County IU 24	72	70	2	16	0	25	47	0
Central Susquehanna IU 16	158	158	0	64	121	12	24	1
Appalachia IU 8	65	64	1	48	29	10	9	17
Allentown S.D.	78	78	0	8	76	0	0	2
Philadelphia S.D.	468	74	394	110	0	0	468	0
Total	1,521	1,033	488	815	741	145	615	20

The general characteristics of those teachers involved in program activities across all seven projects vary considerably in terms of numbers served, qualifications and certifications, and by content area participation.

- A majority of the teachers being served by the MSP programs are Highly Qualified (68%).
- A slight majority of the teachers being served by the MSP programs hold advanced degrees or certifications (54%).
- The MSP programs are serving elementary, middle, and high school teachers as well as teachers of mathematics and science.

Table 5: Math and Science Partnership Program Teacher Knowledge

Project	# of Teachers	# Increase in Math	% Increase Math	# of Increase in Science	% Increase in Science
Scranton S.D.	120	102	85%	108	90%
Aliquippa S.D. - Allegheny IU 3	157	134	85%	NA	NA
Chester County IU 24	35	18	51%	16	46%
Central Susquehanna IU 16	13	13	100%	13	100%
Appalachia IU 8	34	NA	NA	16	47%
Allentown S.D.	30	NA	NA	21	70%
Philadelphia S.D.	*	*	*	*	*
Total	389	267	82%	174	71%

* Data Forthcoming

The outcome of teachers who increase their general knowledge in math or science as a result of participating in a MSP program is encouraging.

- About 82% of teachers increased their content knowledge in Math on pre/post-test teacher content measures in math.
- About 71% of teachers increased their content knowledge in Science on pre/post-test teacher content measures in science.

Table 6: Math and Science Partnership Profile School Data

Project	MSP Schools	Participating MSP Students	Percent Eligible for Free/Reduced Price Lunch
Scranton S.D.	3	1,524	93.0%
Aliquippa S.D. - Allegheny IU 3	31	15,544	60.10%
Chester County IU 24	26	5,430	55.4%
Central Susquehanna IU 16	11	6,594	68.5%
Appalachia IU 8	32	1,117	48.6%
Allentown S.D.	10	5,032	60.0%
Philadelphia S.D.	*	13,464	73.0%
Total	113	48,705	

* Data Forthcoming

The general characteristics of those students involved in program activities across all seven projects also vary somewhat in terms of school profile data.

- There are 113 schools being served by the MSP programs.
- There are 48,705 students being served by the MSP programs.
- The percent of students receiving free or reduced lunch indicates that the MSP program is affecting low-income students, the intended target for student achievement.

Table 7: Math and Science Partnership Program Student Achievement Data (Math)

Project	Mean Proficient K-5	Mean Change	Mean Proficient MS	Mean Change	Mean Proficient HS	Mean Change
Scranton S.D.	72%	52%	NA	NA	NA	NA
Aliquippa S.D. - Allegheny IU 3	56%	-2%	43%	0%	30%	3%
Chester County IU 24	34%	56%	37%	30%	14%	29%
Central Susquehanna IU 16	71%	15%	60%	7%	46%	14%
Appalachia IU 8	71%	30%	66%	0%	43%	-5%
Allentown S.D.	*	*	NA	NA	NA	NA
Philadelphia S.D.	NA	NA	NA	NA	NA	NA
Total	61%	30%	52%	9%	34%	10%

* Data Forthcoming

Most projects provided information on the percent of students' proficient and advanced scores on standardized math assessment tools. In addition, change scores are provided to illustrate the level of impact the MSP programs have effected on math student achievement; however, it is not clear how some of the mean change scores were calculated.

- As evidenced by the positive change scores across all grade categories, a majority of the MSP programs are having a positive effect on math student achievement. It is important to note the greatest effects are occurring at the elementary school level and more modest effects are occurring at the middle school level.
- At the same time, some projects have not reported student achievement data for mathematics and, until data are gathered, it is difficult to assess overall impact on a statewide basis.

Table 8: Math and Science Partnership Program Student Achievement Data (Science)

Project	Mean Proficient K-5	Mean Change	Mean Proficient MS	Mean Change	Mean Proficient HS	Mean Change
Scranton S.D.	69%	53%	NA	NA	NA	NA
Aliquippa S.D. - Allegheny IU 3	*	*	*	*	*	*
Chester County IU 24	35%	23%	50%	34%	32%	47%
Central Susquehanna IU 16	73%	*	72%	*	62%	*
Appalachia IU 8	71%	29%	64%	25%	NA	NA
Allentown S.D.	80%	21%	NA	NA	NA	NA
Philadelphia S.D.	*	*	*	*	NA	NA
Total	66%	32%	62%	30%	47%	47%

* Data Forthcoming

The projects provided information on the percent of students' proficient and advanced scores on standardized science assessment tools. In addition, change scores are provided to illustrate the level of impact the MSP programs have effected on science student achievement; however, it is not clear how some of the mean change scores were calculated.

- As evidenced by the positive change scores for the elementary and middle school levels, some MSP programs are having a positive effect on science student achievement. It is important to note the greatest effects are occurring at the high school level and more modest effects are occurring at the middle school level.
- At the same time, some projects have not reported student achievement data for science and, until data are gathered, it is difficult to determine program impact on a statewide basis.