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Intermediate Trends in Math and Science Partnership-Related Changes in Student Achievement With Management Information System Data

Dimiter M. Dimitrov
George Mason University

This substudy in the evaluation design of the Math and Science Partnership (MSP) Program Evaluation examines student proficiency in mathematics and science for the MSPs' schools in terms of changes across three years (2003/04, 2004/05, and 2005/06) and relationships with MSP-related variables using Management Information System data with the Annual K-12 District Survey. First, changes in percentages of students at or above proficient on state assessments in math and science were investigated by gender, ethnicity, special education, and students with limited English proficiency across the targeted three-year period (2003/04 – 2005/06). The classification of MSP schools with and without focus on math or science during this time period was also taken into account. The results indicated that the MSP-related schools demonstrate sustained increase in percent of students at or above proficient in both math and science at the elementary and middle school levels, but not quite so at the high school level. Second, schools were examined by frequency and effect size of increase, decrease, or no change in student math and science proficiency. The schools with positive changes were in much higher numbers and higher mean effect size of change compared to schools with negative (or no) changes in student math and science proficiency. Third, the relationship between the schools' targeted teacher participation in MSP-related activities over the entire period of three years and the student math and science proficiency at the "end" year of this period (2005-06) was also investigated. This relationship was positive, yet small, at all school levels for mathematics, and also positive, yet much better pronounced, at the high school level for science. Forth, longitudinal growth trajectories in math and science proficiency across the three years were also investigated. The results showed that the schools with MSP focus on math (or science) increase at higher rate in math (or science) proficiency compared to those without MSP focus on math (or science) at the middle school level.

Note from the Editor: All tables and figures are presented at the end of the article.

This study analyzes data from the MSP-Management Information System (MSP-MIS) initiated by NSF as a web-based data collection system. Specifically, the study examines student proficiency in mathematics and science for the MSPs' schools in terms of changes across three years (2003/04, 2004/05, and 2005/06) and relationships with MSP-related variables. The purpose of the MSP-MIS is, in part, to assess the overall implementation of the MSP Program and to monitor the progress of individual MSP grants. Such implementation and monitoring are complex affairs because of the complexity of the MSP grants. The MSP-MIS data are self-reported at the school level. Each grant is a partnership, minimally involving a K-12 district and an institution of higher education (IHE). More often, however, multiple districts and multiple IHEs are engaged in a single MSP grant. The MSP-MIS collects annual data from all grantees, based on multiple instruments. The present study used data from one of the instruments, the Annual K-12 District (school-level) Survey for years 2002/03, 2003/04, 2004/05, and 2005/06. Descriptive analyses from this survey are reported elsewhere (Silverstein, Bell, Frechtling, & Miyaoka, 2005). (Another MSP-MIS instrument provided information on an MSP's math or science focus at the school level.)

The initial year, 2002/2003, is not included in this analysis for two reasons. First, the number of schools that provided MIS data for 2002/03 is disproportionately smaller than those in the subsequent three years. For example, the number of schools with MIS data on math performance across all four years, 2002/03-2005/06, versus the number of schools with such data across the last three years, 2003/04-2005/06, is 24 versus 214, for elementary schools, 15 versus 180, for middle schools, and 5 versus 177, for high schools. Second, the initial trends across the first three years, 2002/03-2004/05, were previously reported by MSP-PE (e.g., Dimitrov, 2006, 2007, 2008; National Science Foundation, 2006, 2007a).

The following four major research questions (RQs) are addressed:

RQ1: What are the trends in mathematics and science proficiency changes across the targeted three-year period (2003/04 – 2005/06) for MSP-related schools based on a) MIS data for all schools that reported student achievement data for any of the three years, and b) longitudinal MIS data — only schools with student achievement data over the three-year period (2003/04 – 2005/06). Of particular interest is the examination of such trends for schools with MSP focus on the subject of interest (math or science) and schools without MSP focus on the subject (math or science).

RQ2: What is the distribution of MSP-related schools across categories of change (increase, decrease, or no change) in math and science proficiency and what is the mean effect size for the categories of significant change (increase or decrease) over the entire three-year period of time (2003/04- 2005/06) for schools with MSP focus on the subject (math or science) and schools without MSP focus on the subject?

RQ3: What are the longitudinal growth trajectories (initial school performance, rate of change, and interaction between them) in math and science proficiency across the three-year period (2003/04 – 2005/06) for schools with MSP focus on the subject (math or science) and schools without MSP focus on the subject?

RQ4: What is the relationship between schools' targeted teacher participation in MSP-related activities over the three-year time period and the schools' success in math and science proficiency at the end year of this time period (2005/06)?

These four research questions address different aspects of changes in math or science proficiency for schools with (or without) MSP focus on math or science across three years (2003/04-2005/06). Specifically, a) RQ1 focuses primarily on the statistical significance of changes and their effect size, b) RQ2 deals with the distribution of schools by direction of change (decrease, no change, increase), c) RQ3 investigates the trajectories of change in terms of initial status in math or science (i.e., proficiency in year 2003/04), rate of change, and possible interaction between these two basic parameters of growth across three years (2003/04-2005/06), and d) RQ4 investigates the relationship between school's targeted teacher participation in MSP-related activities over the three-year time period and the school's success in math and science proficiency at the end year of this time period (2005/06). That is, whether a "critical mass" of three year targeted teacher participation in MSP-related activities can explain the school performance in math and science (percent of students at or above proficient) at the end year (2005/06). The first research question (RQ1) was addressed using MSP-MIS student achievement data from MSP-related schools in two scenarios. Namely, using schools that have reported such data for any of the three years 2003/04, 2004/05, and 2005/06 (in Table 2), and then using only schools that have reported data across these three years (see Table 3).

Tables 2 and 3 also show that there is a substantial overlap in the number of schools assessed in math or science in these two scenarios. For example, the number of common schools in the two scenarios in mathematics at the elementary school level is 245 (out of 320 in 2003/04, 586 in 2004/05, and 762 in 2005/06). For science, also at the elementary school level, there are 114 common schools (out of 135 in 2003/04, 204 in 2004/05, and 308 in 2005/06). Nevertheless, the first scenario data (Table 2) are used only for descriptive purposes, whereas the second scenario data (Table 3) are used for inferential analysis of changes in school math and science proficiency, including effect sizes of such changes, across all three years (2003/04-2005/06).

The second research question (RQ2) was addressed using the longitudinal data from schools with MSP-MIS data on student proficiency in math (or science) across all three years (see Table 3). This question was answered by examining the frequency distribution of MSP-related schools across categories of change (increase, decrease, or no change) in math and science proficiency, as well as the mean effect size for the categories of significant change (increase or decrease) over the entire three-year period of time (2003/04- 2005/06).

The third research question (RQ3) was also addressed using the longitudinal data from schools with MSP-MIS data on student proficiency in math (or science) across all three years (see Table 3). The school scores in this longitudinal analysis were adjusted for the school's sample size and score variation. This was done by weighting the school's proportion of students at or above proficient in math (or science) by the reciprocal of the standard error of this proportion:

$$Adjusted\ p_i = p_i / s_i \qquad (1)$$

where p_i is the school's proportion of students at or above proficient in math (or science) and s_i is the standard error: $s_{p_i} = \sqrt{p_i(1 - p_i/n_i)}$ with n_i being the sample size of the ith school — that is, the number of students assessed in math (or science) in school i.

With this score adjustment, if some schools have equal initial scores, p_i, the larger the school sample size, n_i, the larger the factor by which the school score (proportion of students at or above proficient) will increase. Along with improving the reliability and validity by using weighted scores (e.g., Kane & Case, 2004), the score adjustment in this case was necessary because the growth analysis involves the school means and, therefore, averaging proportions that come from schools with different sample size would produce misleading results. After the adjustment, the square root transformation was applied to the resulting scores, with the purpose to reduce the (positive) skewness of their original distributions, thus improving the technical conditions required with this type of longitudinal growth modeling (e.g., Snedecor & Cochran, 1989; Stevens, 2002). The square root transformation makes the data distribution more suitable for the analytic procedures involved in the growth analysis with RQ3 and does not lead to problems with validity of interpretations. The relationship between the original and adjusted proportions was found to be positive monotonic with a Pearson correlation of .73 between them. It is important to emphasize in this regard that the main purpose of RQ3 is to examine growth trajectories in math and science proficiency for two groups of schools — *with* or *without* MSP focus on math (or science) — not to compare these two groups of schools on their original percent of student proficiency; (such comparisons are addressed, from different angles, with research questions RQ1 and RQ2).

Finally, the fourth research question (RQ4) was addressed using schools for which MSP-MIS data were available on targeted teacher participation at any of the three years (2003/04-2005/06) and student achievement data for the last year (2005/06). As alluded to earlier, the idea was to investigate the relationship between the school's "critical mass" of targeted teacher participation in MSP-related activities over all three years and student math and science proficiency at the end of this time period. It is important to note also that the variable "targeted teacher participation in MSP-related activities" is not involved in the previous three research questions.

Tables 2 and 3 summarize the information about the data that have been used in statistical analyses related to each of the research questions addressed in this study.

Method

Data

From the Annual K-12 District Survey, the data used in this paper covered schools with available data for the four research questions as described in the previous section. Table 2 provides data on number of schools for which MSP-MIS data on student math or science proficiency were available for any of the three years (2003/04, 2004/05, and 2005/06), number of students in these schools who had taken the state assessment in math or science, *n*, and number of students who "pass" (at or above proficient) the assessment. The data are also provided by gender, ethnicity, special education students, and limited English proficiency students. Table 2 shows, for example, that the highest relative sample representation of schools is for mathematics at the elementary school level. Table 3 includes only schools with MSP-MIS student achievement data across all three years (2003/04-2005/06).

Variables and Scales

There are three main variables investigated in this school-level MSP-MIS study:

1. S*tudent achievement* — the proportion of students at or above proficient on state assessments in mathematics and science, calculated by the number of students attaining proficiency divided by the total number of students taking the test;
2. *Targeted teacher participation in MSP-related activities* — this variable is identified in MSP-MIS by the condition that 30 percent or more of a school's targeted teachers participated in 30 or more hours of MSP-sponsored activities during a single school year. Given the binary scale (1 if the condition was met, and 0 otherwise), the score for any school on this specific variable over three school years (2003/04, 2004/05, and 2005/06) may vary from zero to three (0 = the condition was not met during any of the three years, and 3 = the condition was met all three years); and
3. MSP focus on math (or science) for each school (0 = No, 1 = Yes), with "yes" meaning that the MSP indicated such a focus in any of the three years being studied.

Statistical Analysis

All research questions were addressed by school level (elementary, middle, and high school). To address RQ1, longitudinal analyses were conducted to compare schools with an MSP focus on math (or science) versus schools without such focus on trends and effect size of changes in percent of students at or above proficient. Cohen's effect size (ES) index for a difference in two proportions, *h* (Cohen, 1988), was calculated for each school with a statistically significant change (increase or decrease). The *h* effect size for the difference in two proportions, say $P_1 - P_2$, is:

$h = 2arcsin\sqrt{P_1} - 2arcsin\sqrt{P_2}$. The magnitude of the effect size is operationally defined as *small* (*h* = .20), *medium* (*h* = .50), and *large* (*h* = .80) effect size (Cohen, 1988, p. 181).

To address RQ2, each school was assigned to one of three categories of change in terms of percent of students at or above proficient in math or science: *increase* — if the school has a statistically significant positive change, *decrease* — if the school has a statistically significant negative change, and *no change* — if the school's change was not statistically significant. The frequency distribution of schools by direction of change (increase, decrease, no change) in math and science proficiency was examined by schools *with* or *without* MSP focus on math (or science). The *changes* across three school years were measured by the differences in percent of students at or above proficient on state assessments in mathematics and science from 2003/04 to 2004/05 (*one-year immediate change*) and from 2003/04 to 2005/06 (*two-year sustained change*).

To address RQ3, longitudinal growth modeling was applied to adjusted scores of school proficiency in math and science to investigate the *initial status* (intercept) and *rate of change* (slope), as well as possible interaction between them, in growth trajectories of school proficiency in math and science across all three years (2003/04-2005/06). The role of schools with (or without) MSP focus on the respective subject matter (math or science) was also taken into account with this longitudinal growth analysis. Longitudinal growth modeling (LGM; e.g., Muthén, 2004) was employed with the individual schools being the units of analysis, the square root of the adjusted school proportion of students at or above proficient (see Equation 1) being the outcome variable across three years (2003/04, 2004/05, and 2005/06), and the school variable "MSP focus on math or science" (0 = No, 1 = Yes) being a background variable. Graphically, the LGM used in this study is depicted in Figure 1. The longitudinal growth analysis was conducted separately for math and science at each (elementary, middle, and high) school level using the computer program M*plus* (Muthén & Muthén, 2007).

To address RQ4, the Pearson product-moment correlation was used to investigate the relationship between the school's targeted teacher participation in MSP-related activities over the time period of all three years and student math and science proficiency at the end of this time period (2005/06). This analysis was conducted separately for math and science at each (elementary, middle, and high) school level.

Results

The results are reported in four parts representing the four research questions (RQ1, RQ2, RQ3, and RQ4) addressed in this MSP-PE substudy.

Trends and Effect Sizes of Changes in Math and Science Proficiency

This section provides results related to the first research questions, RQ1: "What are the trends in mathematics and science proficiency changes across the targeted three-year period (2003/04 – 2005/06) for MSP-related schools based on MIS data for all schools that reported student achievement data for any of the three years, and *longitudinal* MIS data — only schools with student achievement data across all three years (2003/04-2005/06). Of particular interests is the examination of such trends for schools *with* MSP focus on the subject of interest (math or science) and schools *without* MSP focus on the subject (math or science)."

The results are presented separately for student achievement in mathematics and science. The change of each school in percent of students at or above proficient in math (or science) is tested for statistical significance using 90% confidence intervals (90% CI) for the change. The choice of 90% CI over 95% CI was guided by the principle of increasing test power.

Mathematics. Figures 2 and 3 (upper panels) show the percent of students at or above proficient on state assessments in mathematics by school level (elementary, middle, and high) for all schools with MSP-MIS student achievement data at any of the three years (2003/04-2005/06) and only for schools with MSP-MIS student achievement data across all three years, respectively. The trends of school changes in math proficiency delineated in these two exhibits are very similar due to the fact that the data used for Figure 3 (upper panel) is a substantial subset of the data used for Figure 2 (upper panel) (see also Tables 1 and 2). Therefore, the school data used for Figure 3 (upper panel), that is, student achievement data available across all three years, were also used for inferential comparisons and calculation of effect sizes for school changes in math proficiency across the three years (2003/04-2005/06) (see Table 3).

Figures 2 and 3 (upper panels) also show that there is a sustained increase in math proficiency at the elementary and middle school levels, but not at the high school level — specifically, there is an initial decrease (2003/04-2004/05) after which the math proficiency for high schools remains stable. The results by schools *with* (or *without*) MSP focus on math are presented with Table 4 and Figure 4. Clearly, the elementary and middle schools with MSP focus on math show a consistent increase in math proficiency, with the largest effect size ($ES = +.35$) for the sustained increase from 2003/04 to 2005/06. Conversely, the elementary and middle schools without MSP focus on math show an overall decrease in math proficiency (with the exception of a slight initial increase, $ES = +.09$, for middle schools). At the high school level, however, the math proficiency change is not in favor of schools *with* MSP focus on math. Specifically, there is a small decrease for these schools versus a small increase for high schools *without* MSP focus on math.

By gender, the results in Table 5 show that the largest (2003/04-2005/06) increase in math proficiency for both males and females is at the elementary school level, with a close to medium effect size (*ES* = +.35). By ethnicity, the results in Table 6 show that the largest (2003/04-2005/06) increase in math proficiency is for the elementary school *with* MSP focus on math — (small to medium) effect size for African-American students (*ES* = +.37), Hispanic students (*ES* = +.37), and students who have not reported their ethnicity (ES = +. 31). An exception is the sizable increase in math proficiency (medium to high effect size: *ES* = +.54) at the high school level for students in the "other" grouping by ethnicity from the schools *without* MSP focus on math. Further, the results in Table 7 show that a) for special education students, the overall positive change in effect size is in favor of schools *with* MSP focus, and b) this trend is even stronger for students with limited English proficiency at the elementary and middle school levels, but not at the high school level.

Science. Figures 2 and 3 (lower panels) show that there is a substantial increase in science proficiency at the elementary school level, less pronounced increase for the middle schools, and an initial decrease, followed up by a very small increase, at the high school level. The results by schools with (or without) MSP focus on science are presented with Table 8 and Figure 5. The effect size results in Table 8 show that, overall, the schools *with* MSP focus on science do better than those *without* MSP focus on science at the elementary and middle school levels, but this is not the case at the high school level. High schools *with* MSP focus on science exhibit a close to medium decrease (*ES* = –.36), whereas high schools *without* MSP focus on science exhibit a small increase (*ES* = +.14) in science proficiency (2003/04-2005/06). Note that the comparison by “percent proficient students” can be misleading due to the much larger sample size of students (and schools) for schools *with* MSP focus on science compared to MSP schools *without* focus on science. The effect size takes this into account and represents a more valid scale for comparison of changes in student proficiency.

By gender, the results in Table 9 show that the largest (2003/04-2005/06) increase in science proficiency is for the elementary schools *with* MSP focus on science, with small effect size for both males and females (*ES* = +.21). By ethnicity, the results in Table 10 show that the largest (2003/04-2005/06) increase in science proficiency is for schools *with* MSP focus on science . There is an increase of medium effect size for the African-American students (*ES* = +.47) and Asian students (*ES* = +. 42), at the elementary school level, and for Asian students at the middle school level (*ES* = +.36).

For special education students, the largest (2003/04-2005/06) increase in science proficiency is for the middle schools *with* MSP focus on science (*ES* = +.56) (see Table 11). For students with limited English proficiency, the largest (2003/04-2005/06) increase in science proficiency is at the middle school level, but with *ES* +.56 for schools *without* MSP focus on science and *ES* = +.30 for schools with MSP focus on science. There is a similar trend at the elementary school level for these students, with *ES* = +.30 for schools *without* MSP focus on science and *ES* = +.21 for schools with MSP focus on science. However, there is no change in science proficiency at the high school level for these students (see Table 11).

Schools by Direction of Change in Math and Science Proficiency

The results in this section relate to the second research question, RQ2: “What is the distribution of MSP-related schools across categories of change (increase, decrease, or no change) in math and science proficiency and what is the mean effect size for the categories of significant change (increase or decrease) over the entire three-year period of time (2003/04- 2005/06) for schools *with* MSP focus on the subject (math or science) and schools *without* MSP focus on the subject?”

Specifically, this section provides information about the percentage of schools by direction of change (increase, decrease, no change) in math and science proficiency over a two-year period (2003/04-2005/06), separately for schools with and without MSP focus on math (or science) — see Figures 6, 7 and 8, for math, and Figures 9, 10, and 11, for science.

Clearly, the percentage of schools with a two-year increase is much higher than the percentage of schools with a two-year decrease at all school levels for both math and science. For schools that fall into the "increase" category, the percentage of schools *with* focus on math (or science) is higher than the percentage of schools *without* focus on math (or science) at the elementary and middle school levels for both math and science (see Figures 6, 7, 9, and 10). This, is not the case at the high school level (Figures 8 and 11).

Longitudinal Growth Trajectories in School Math and Science Proficiency

The results in this section relate to the third research questions, RQ3: “What are the longitudinal growth trajectories (initial school performance, rate of change, and interaction between them) in math and science proficiency across the three-year period (2003/04 – 2005/06) for schools *with* MSP focus on the subject (math or science) and schools *without* MSP focus on the subject?”

The longitudinal growth model (LGM) of changes in school math and science proficiency across three years (2003/04-2005/06) is depicted in Figure 1. The results are summarized in Table 12. The unit of measurement are individual schools, the school score is the adjusted proportion of students at or above proficient (see Equation 1), and the school "MSP focus on math (or science)" is a background variable (0 = No, 1 = Yes).

The results for tests of model fit in Table 12 show that the LGM model fits the school data fairly well, given the following three criteria of a good model fit used in this study: *Comparative Fit Index* (CFI > .95), *Tucker-Lewis Index* (TLI > .95), and *Standardized Root Mean Square Residual* (SRMR < .06). For the estimates of the CFI, for example, with the exception of a slightly lower CFI at the elementary school level (.844), all CFIs vary from .959 to .999 — see Table 12.

Given the coding (0 = No, 1 = Yes) for the school variable "MSP focus on math (or science)," the statistically significant coefficients in the column "Initial Status on MSP

Focus" in Table 12 indicate that a) the schools with MSP focus on math have higher initial status (higher adjusted proficiency score in 2003/04) than those without MSP focus on math at the elementary and high school levels (0.33 and 0.37), but not on the middle school level (-1.46); and b) the schools with MSP focus on science have lower initial status (lower adjusted proficiency score in 2003/04) than those without MSP focus on science at the elementary school level (-1.63).

The statistically significant positive coefficients in the column "Rate of Change on MSP Focus" in Table 12 show that a) the schools with MSP focus on math increase at higher rate in math proficiency compared to those without MSP focus on math at the middle school level (0.25), and b) the schools with MSP focus on science increase at higher rate in science proficiency compared to those without MSP focus on science at the middle school level. Still in Table 12, the statistically significant negative correlation coefficient (-.53) in the column “Initial Status correlated with Rate of Change” indicates that middle schools with lower initial proficiency in math increase at a higher rate. On the other hand, the statistically significant positive correlation coefficient (.25) shows that high schools with higher initial proficiency in science increase with higher rate.

Relationship Between Targeted Teacher Participation in MSP-related Activities and Student Proficiency in Math and Science

The results in this section relate to the fourth research question, RQ4: “What is the relationship between schools’ targeted teacher participation in MSP-related activities over the three-year time period and the schools’ success in math and science proficiency at the end year of this time period (2005/06)?”

Specifically, this section provides results about the relationship between the targeted teacher participation in MSP-related activities over the span of three years (2003/04-2005/06) and the student proficiency in math and science at the end year (2005/06). The Pearson product-moment correlation coefficients for this relationship at the elementary, middle, and high school levels are provided in Table 13. The presence (or lack) of statistical significance for these coefficients and their magnitudes reveals that the relationship between the targeted teacher participation in MSP-related activities and student proficiency is statistically significant and positive (yet, small) at all school levels for mathematics, and statistically significant and well pronounced (r = .473) at the high school level for science.

Discussion

This study examines intermediate trends in MSP-related changes in student math and science proficiency using MSP-MIS data with the Annual K-12 District Survey for three years, 2003/04, 2004/05, and 2005/06. The results are summarized by the topics of the four research questions addressed in this study.

Trends of Changes in Math and Science Proficiency

The MSP-related schools demonstrate sustained increase in percent of students at or above proficient in both math and science at the elementary and middle school levels across years 2003/04, 2004/05, and 2005/06. This, however is not the case at the high school level, with an initial decrease (2003/04-2004/05) after which the proficiency for high schools remains stable for both math and science. The elementary and middle schools *with* MSP focus on math show a consistent increase in math proficiency, with the largest effect size for the sustained increase from 2003/04 to 2005/06 at the elementary school level. Conversely, the schools *without* MSP focus on math show an overall decrease in math proficiency at the elementary and middle school levels. At the high school level, however, the math proficiency change is not in favor of schools *with* MSP focus on math. There is a small decrease for high schools with MSP focus on math versus a small increase for high schools *without* MSP focus on math over the period from 2003/04 to 2005/06.

By gender, the largest (2003/04-2005/06) increase in both math and proficiency is at the elementary school level, with the same magnitude for both males and females — specifically, a close to medium effect size math and a small effect size in science. By ethnicity, the largest (2003/04-2005/06) increase in student proficiency is at the elementary school level — for African-American students and Hispanic students in math, and for African American students and Asian students in science. At the middle school level, the increase in math proficiency is relatively small and about the same for all ethnic groups. A close to medium increase in science proficiency for Asian students is followed by a small increase for African-American students, and negligible increase for White and Hispanic students.

For special education students, the largest (2003/04-2005/06) increase in math proficiency, with a small effect size, is at the elementary school level, whereas the largest increase in science for these students is at the middle school level, with a medium to large effect size. For students with limited English proficiency, the largest (2003/04-2005/06) increase in math proficiency, with a medium effect size, is at the elementary school level, whereas the largest increase in science proficiency for these students is at the middle school level, with a small to medium effect size.

Schools by Direction of Change in Math and Science Proficiency

For both math and science, the percentage of schools with an increase in student proficiency is higher than that with a decrease in student proficiency at all school levels over the period from 2003/04 to 2005/06. Also, for schools that fall into the "increase" category, the percentage of schools *with* MSP focus on math (or science) is higher than that of schools *without* MSP focus on math (or science) at the elementary and middle school levels for math (or science). This, however, is not the case at the high school level.

The schools *with* MSP focus on math have higher initial (2003/04) proficiency in math than those *without* MSP focus on math at the elementary and high school levels, but not on the middle school level. On the other side, the schools with MSP focus on science have lower initial proficiency in science than those without MSP focus on science at the elementary school level. The schools with MSP focus on math (or science) increase at higher rate in math (or science) proficiency compared to those without MSP focus on math (or science) at the middle school level. Middle schools with lower "start" (initial proficiency) in math increase at a higher rate in math proficiency across the three years (2003/04-2005/06). High schools with higher "start" (initial proficiency) in science increase with higher rate in science proficiency across the three years (2003/04-2005/06).

Relationship Between Targeted Teacher Participation in MSP-related Activities and Student Proficiency in Math and Science

The relationship between the targeted teacher participation in MSP-related activities and student proficiency is positive (yet, small) at all school levels for mathematics, and positive, and better pronounced, at the high school level for science.

Limitations and Upcoming Analyses

The results in this study must be interpreted with understanding of limitations that stem from restricted MIS data with the Annual K-12 District Survey. One limitation, for example, is the lack of matching data from "control" schools (not involved in MSP) to evaluate the degree to which the changes in students' proficiency in math and science can be attributed to school participation in MSP. That is why this study does not engage in testing a hypothesis about the degree to which the delineated trends in math and science performance of MSP-related schools are different from trends that may exist in non-MSP related schools. A strong insight in this regard, however, is provided by the comparisons of MSP-related schools *with* and *without* MSP focus on math (or science) on different aspects of changes in math (or science) proficiency across the three years — *percent of students at or above proficient*, *distribution of schools by direction of change* (decrease, no change, increase), and *growth trajectories* (initial status in proficiency, rate of change, and interaction between them). Additional evidence about explanatory effects of MSP-related activities in schools on student proficiency in math and science is sought through the fourth research question by analyzing the correlation between the targeted teacher participation in MSP-related activities and student proficiency. Triangulations with findings in other MSP-PE substudies that control for MSP participation of schools (e.g., Wong & Socha, 2008) may provide more evidence on the role of MSP factors in the math and science proficiency of MSP-related schools.

Another potential limitation stems from the lack of MIS data that can be used to equate school proficiency measures in math and science across states. It should be noted, however, that mapping state performance standards on to a common scale (e.g., using *NAEP* data) is a difficult task still challenging the research on large-scale performance analyses (e.g., Braun & Qian, 2007; McLaughlin & Bandeira de Mello, 2003). The purpose of such equating is to take into account differences (in content and passing standards) among state assessments in math and science for the comparison of states on a common scale. Such comparisons, however, are not targeted in this study. Instead, the focus here is on changes and growth trajectories in student math and science proficiency and its relationship with school's targeted teacher participation in MSP-related activities.

When necessary, the aggregation of schools (e.g., by elementary, middle, and high school level) was done not by averaging the proportions of students at or above proficient across schools, but by aggregating the number of students assessed and the number of those who "pass" (at or above proficient) thus producing a "clean" measure of student proficiency at the aggregated school level. Likewise, the measure of school proficiency by direction of change (decrease, no change, increase) in math or science proficiency, used with RQ2, is based on testing for statistical significance of the change for each school, and not on aggregated proportions across schools. When averaging of proportions was necessary with the growth modeling in RQ3, it was done after adjusting the proportions for school size and variability in math and science proficiency.

In upcoming analyses with the continuation of this study, efforts will be directed in reducing validity threats associated with aggregation of student achievement trends across states — e.g., through a) mapping the aforementioned binary scores of change in school math or science proficiency on (IRT derived) scale, b) weighting the proportions of students at or above proficient in math or science, c) using standardized effect sizes, and d) mapping state performance standards on to a common scale when appropriate data (collected outside MIS) is available. Additional analyses that can counteract the limitations with this study are also next steps in the MSP-PE agenda. Such analyses (e.g., using math and science course credit teacher training data) can further expand our understanding of the relationship between MSP-participation and student math and science achievement.

In conclusion, despite limitations in scope and depth of the analysis in this study, due primarily to data restrictions with the MIS Annual K-12 District Survey, the results indicate promising trends and relationships between student proficiency in mathematics and science and MSP-related variables.

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Table 1
Data Sets Used in the Statistical Analysis by Research Questions

Research Question	Data
RQ1: What is the distribution of MSP-related schools across categories of change (increase, decrease, or no change) in math and science proficiency and what is the mean effect size for the categories of significant change (increase or decrease) over the entire three-year period of time (2003/04- 2005/06) for schools *with* MSP focus on the subject (math or science) and schools *without* MSP focus on the subject?	MSP-MIS student achievement data from MSP-related schools in two scenarios: a) using schools that have reported such data for any of the three years (Table 2), and b) using only schools that have reported data across all three years (Table 3).
RQ2: What is the distribution of MSP-related schools across categories of change (increase, decrease, or no change) in math and science proficiency and what is the mean effect size for the categories of significant change (increase or decrease) over the entire three-year period of time (2003/04- 2005/06) for schools *with* MSP focus on the subject (math or science) and schools *without* MSP focus on the subject?	Longitudinal data from schools with MSP-MIS data on student proficiency in math (or science) across all three years (Table 3).
RQ3: What are the longitudinal growth trajectories (initial school performance, rate of change, and interaction between them) in math and science proficiency across the three-year period (2003/04 – 2005/06) for schools *with* MSP focus on the subject (math or science) and schools *without* MSP focus on the subject?	Longitudinal data from schools with MSP-MIS data on student proficiency in math (or science) across all three years (Table 3).The school scores were adjusted for the school's sample size and score variation.
RQ4: What is the relationship between schools' targeted teacher participation in MSP-related activities over the three-year time period and the schools' success in math and science proficiency at the end year of this time period (2005/06)?	Schools for which MSP-MIS data that were available on targeted teacher participation at any of the three years (2003/04-2005/06) and student achievement data for the last year of this time period (2005/06).

Table 2

MSP-MIS Cross-Sectional Data for Number of Schools, Number of Students Assessed and Number of Students at or Above Proficient at State Assessments in Mathematics and Science Across Three School Years: 2003/04, 2004/05, and 2005/06

	MATHEMATICS			SCIENCE		
	Elementary Schools	Middle Schools	High Schools	Elementary Schools	Middle Schools	High Schools
All students						
2003/04	*n* = 53363 pass = 25288 320 schools	*n* = 98270 pass = 35633 227 schools	*n* = 97675 pass = 39774 213 schools	*n* = 10942 pass = 3515 135 schools	*n* = 20682 pass = 8500 96 schools	*n* = 46026 pass = 23858 130 schools
2004/05	*n* = 97534 pass = 59417 586 schools	*n* = 195131 pass = 81836 358 schools	*n* = 166068 pass = 59971 312 schools	*n* = 17826 pass = 8208 204 schools	*n* = 52907 pass = 30870 192 schools	*n* = 104732 pass = 38063 210 schools
2005/06	*n* = 164369 pass = 107039 762 schools	*n* = 318916 pass = 152851 521 schools	*n* = 199838 pass = 72493 381 schools	*n* = 33859 pass = 20388 308 schools	*n* = 93200 pass = 47019 275 schools	*n* = 121547 pass = 46884 251 schools
Males						
2003/04	*n* = 26975 pass = 12602 (320 schools)	*n* = 49878 pass = 17866 (227 schools)	*n* = 49044 pass = 20049 (213 schools)	*n* = 5348 pass = 1686 (135 schools)	*n* = 10513 pass = 4417 (96 schools)	*n* = 23015 pass = 12165 (130 schools)
2004/05	*n* = 44102 pass = 26046 (490 schools)	*n* = 81262 pass = 30874 (293 schools)	*n* = 78859 pass = 27307 (266 schools)	*n* = 7921 pass = 3253 (193 schools)	*n* = 15086 pass = 7627 (142 schools)	*n* = 49283 pass = 17696 (173 schools)
2005/06	*n* = 78846 pass = 49611 (704 schools)	*n* = 143821 pass = 69459 (471 schools)	*n* = 88549 pass = 34086 (345 schools)	*n* = 16382 pass = 9850 (285 schools)	*n* = 44461 pass = 23316 (255 schools)	*n* = 58106 pass = 23317 (227 schools)
Females						
2003/04	*n* = 26064 pass = 12553 (320 schools)	*n* = 48361 pass = 17749 (227 schools)	*n* = 48245 pass = 19476 (213 schools)	*n* = 5350 pass = 1720 (135 schools)	*n* = 10156 pass = 4077 (96 schools)	*n* = 22853 pass = 11589 (130 schools)
2004/05	*n* = 42317 pass = 25515 (490 schools)	*n* = 79609 pass = 30329 (293 schools)	*n* = 77105 pass = 26515 (266 schools)	*n* = 7700 pass = 3120 (193 schools)	*n* = 14535 pass = 7103 (142 schools)	*n* = 48086 pass = 16421 (173 schools)
2005/06	*n* = 75919 pass = 48491 (704 schools)	*n* = 140155 pass = 69807 (471 schools)	*n* = 87706 pass = 33688 (345 schools)	*n* = 15960 pass = 9750 (285 schools)	*n* = 43851 pass = 22309 (254 schools)	*n* = 57726 pass = 21908 (225 schools)

Table 2 (continued)

	MATHEMATICS			SCIENCE		
	Elementary Schools	*Middle* Schools	*High* Schools	*Elementary* Schools	*Middle* Schools	*High* Schools
White						
2003/04	n = 12333 pass = 9318 (320 schools)	n = 26345 pass = 17108 (227 schools)	n = 20916 pass = 13044 (213 schools)	n = 4476 pass = 1998 (135 schools)	n = 8798 pass = 5560 (96 schools)	n = 13160 pass = 9535 (130 schools)
2004/05	n = 27473 pass = 21611 (495 schools)	n = 47433 pass = 32551 (329 schools)	n = 34966 pass = 21716 (283 schools)	n = 5984 pass = 3606 (193 schools)	n = 14890 pass = 10435 (170 schools)	n = 22800 pass = 15768 (190 schools)
2005/06	n = 62575 pass = 46465 (704 schools)	n = 99768 pass = 68278 (467 schools)	n = 39926 pass = 25129 (329 schools)	n = 10174 pass = 7200 (281 schools)	n = 22604 pass = 16559 (241 schools)	n = 23471 pass = 16540 (209 schools)
African American						
2003/04	n = 6668 pass = 2386 (320 schools)	n = 13227 pass = 3032 (227 schools)	n = 8394 pass = 2292 (213 schools)	n = 1320 pass = 229 (135 schools)	n = 5031 pass = 875 (96 schools)	n = 5296 pass = 2445 (130 schools)
2004/05	n = 14653 pass = 7037 (418 schools)	n = 24594 pass = 6743 (296 schools)	n = 16843 pass = 3936 (259 schools)	n = 2340 pass = 737 (125 schools)	n = 6463 pass = 1843 (141 schools)	n = 11658 pass = 3390 (166 schools)
2005/06	n = 38796 pass = 24190 (616 schools)	n = 48151 pass = 18776 (417 schools)	n = 18756 pass = 5756 (291 schools)	n = 12669 pass = 8774 (205 schools)	n = 21116 pass = 8302 (196 schools)	n = 13106 pass = 4687 (177 schools)
Hispanic/Latino						
2003/04	n = 30588 pass = 11514 (320 schools)	n = 48220 pass = 9555 (227 schools)	n = 61155 pass = 20766 (213 schools)	n = 3835 pass = 803 (135 schools)	n = 4386 pass = 1027 (96 schools)	n = 22838 pass = 9148 (130 schools)
2004/05	n = 44831 pass = 24143 (586 schools)	n = 102259 pass = 31277 (358 schools)	n = 100665 pass = 28611 (312 schools)	n = 8178 pass = 3327 (204 schools)	n = 26366 pass = 16635 (192 schools)	n = 60487 pass = 14577 (210 schools)
2005/06	n = 46059 pass = 23164 (762 schools)	n = 123816 pass = 44444 (521 schools)	n = 107894 pass = 32418 (381 schools)	n = 7712 pass = 2662 (308 schools)	n = 39578 pass = 17344 (275 schools)	n = 68828 pass = 18339 (251 schools)
Asian						
2003/04	n = 399 pass = 291 (320 schools)	n = 5380 pass = 3905 (227 schools)	n = 3903 pass = 2175 (213 schools)	n = 248 pass = 119 (135 schools)	n = 627 pass = 286 (96 schools)	n = 2326 pass = 1595 (130 schools)
2004/05	n = 1202 pass = 831 (417 schools)	n = 7516 pass = 5350 (298 schools)	n = 5431 pass = 2503 (257 schools)	n = 259 pass = 162 (125 schools)	n = 762 pass = 435 (139 schools)	n = 4399 pass = 2439 (165 schools)
2005/06	n = 1918 pass = 1414 (614 schools)	n = 10863 pass = 8223 (407 schools)	n = 6066 pass = 3048 (285 schools)	n = 493 pass = 357 (204 schools)	n = 3129 pass = 2420 (197 schools)	n = 4492 pass = 2639 (174 schools)
Other						
2003/04	n = 914 pass = 394 (320 schools)	n = 2052 pass = 789 (227 schools)	n = 849 pass = 266 (213 schools)	n = 278 pass = 33 (135 schools)	n = 256 pass = 75 (96 schools)	n = 221 pass = 48 (130 schools)
2004/05	n = 1306 pass = 808 (586 schools)	n = 2578 pass = 1170 (358 schools)	n = 2307 pass = 520 (312 schools)	n = 141 pass = 54 (204 schools)	n = 319 pass = 98 (192 schools)	n = 1523 pass = 311 (210 schools)
2005/06	n = 2698 pass = 1549 (762 schools)	n = 3590 pass = 1560 (521 schools)	n = 2165 pass = 555 (381 schools)	n = 522 pass = 364 (308 schools)	n = 990 pass = 526 (275 schools)	n = 1543 pass = 451 (251 schools)

Table 2 (continued)

	MATHEMATICS			SCIENCE		
	Elementary Schools	Middle Schools	High Schools	Elementary Schools	Middle Schools	High Schools
Special Education Students						
2003/04	*n* = 4748 pass = 1451 (320 schools)	*n* = 9071 pass = 1352 (227 schools)	*n* = 6874 pass = 1020 (213 schools)	*n* = 993 pass = 157 (135 schools)	*n* = 2797 pass = 552 (96 schools)	*n* = 2526 pass = 712 (130 schools)
2004/05	*n* = 8864 pass = 3108 (431 schools)	*n* = 13436 pass = 2301 (255 schools)	*n* = 9772 pass = 1490 (242 schools)	*n* = 1419 pass = 411 (142 schools)	*n* = 3361 pass = 853 (118 schools)	*n* = 5945 pass = 1011 (163 schools)
2005/06	*n* = 16013 pass = 6538 (635 schools)	*n* = 21657 pass = 4161 (395 schools)	*n* = 10042 pass = 1679 (247 schools)	*n* = 3072 pass = 1554 (221 schools)	*n* = 6847 pass = 1599 (208 schools)	*n* = 6206 pass = 1056 (163 schools)
Limited English Proficiency Students						
2003/04	*n* = 21867 pass = 7334 (320 schools)	*n* = 33610 pass = 5226 (227 schools)	*n* = 26748 pass = 4323 (213 schools)	*n* = 1770 pass = 134 (135 schools)	*n* = 1135 pass = 121 (96 schools)	*n* = 8269 pass = 829 (130 schools)
2004/05	*n* = 30413 pass = 14462 (420 schools)	*n* = 64655 pass = 12509 (239 schools)	*n* = 63460 pass = 8991 (232 schools)	*n* = 3713 pass = 438 (133 schools)	*n* = 1363 pass = 188 (97 schools)	*n* = 45470 pass = 4692 (150 schools)
2005/06	*n* = 31687 pass = 14782 (625 schools)	*n* = 53339 pass = 10378 (387 schools)	*n* = 41657 pass = 5858 (249 schools)	*n* = 3480 pass = 583 (217 schools)	*n* = 10503 pass = 1344 (196 schools)	*n* = 23481 pass = 1757 (155 schools)

Note. *n* = number of students assessed; pass = number of students who “pass” (at or above proficient) the state assessment.

Table 3

MSP-MIS Longitudinal Data for Number of Students Assessed and Number of Students at or Above Proficient at State Assessments in Mathematics and Science – Same Schools Across Years 2003/04, 2004/05, and 2005/06

	MATHEMATICS			SCIENCE		
	Elementary Schools	Middle Schools	High Schools	Elementary Schools	Middle Schools	High Schools
All students						
2003/04	*n* = 44409 pass = 20405 (245 schools)	*n* = 90046 pass = 32714 (196 schools)	*n* = 94878 pass = 38417 (192 schools)	*n* = 9417 pass = 2747 (114 schools)	*n* = 11099 pass = 5273 (57 schools)	*n* = 44492 pass = 22814 (116 schools)
2004/05	*n* = 46523 pass = 26732 (245 schools)	*n* = 110187 pass = 41361 (196 schools)	*n* = 122847 pass = 41975 (192 schools)	*n* = 9336 pass = 3290 (114 schools)	*n* = 10873 pass = 5329 (57 schools)	*n* = 75218 pass = 26111 (116 schools)
2005/06	*n* = 57577 pass = 33942 (245 schools)	*n* = 119893 pass = 48170 (196 schools)	*n* = 124088 pass = 42758 (192 schools)	*n* = 9065 pass = 3480 (114 schools)	*n* = 10750 pass = 5480 (57 schools)	*n* = 77832 pass = 27048 (116 schools)
Males						
2003/04	*n* = 22576 pass = 10209 (241 schools)	*n* = 45697 pass = 16398 (198 schools)	*n* = 47681 pass = 19378 (194 schools)	*n* = 4741 pass = 1363 (114 schools)	*n* = 5596 pass = 2691 (57 schools)	*n* = 22278 pass = 11671 (116 schools)
2004/05	*n* = 23412 pass = 13263 (245 schools)	*n* = 54941 pass = 20618 (196 schools)	*n* = 61216 pass = 20922 (192 schools)	*n* = 4667 pass = 1635 (114 schools)	*n* = 4932 pass = 2509 (57 schools)	*n* = 37567 pass = 13311 (116 schools)
2005/06	*n* = 29084 pass = 16364 (245 schools)	*n* = 59993 pass = 22244 (196 schools)	*n* = 61467 pass = 21186 (192 schools)	*n* = 4484 pass = 1678 (114 schools)	*n* = 4864 pass = 2575 (57 schools)	*n* = 38776 pass = 13838 (116 schools)
Females						
2003/04	*n* = 21823 pass = 10190 (241 schools)	*n* = 44326 pass = 16300 (198 schools)	*n* = 46886 pass = 18850 (194 schools)	*n* = 4669 pass = 1384 (114 schools)	*n* = 5495 pass = 2580 (57 schools)	*n* = 22119 pass = 11095 (116 schools)
2004/05	*n* = 22485 pass = 13100 (245 schools)	*n* = 53762 pass = 20190 (196 schools)	*n* = 59444 pass = 20235 (192 schools)	*n* = 4558 pass = 1584 (114 schools)	*n* = 4772 pass = 2410 (57 schools)	*n* = 36432 pass = 12345 (116 schools)
2005/06	*n* = 27952 pass = 16092 (245 schools)	*n* = 58346 pass = 22195 (196 schools)	*n* = 59793 pass = 20464 (192 schools)	*n* = 4430 pass = 1705 (114 schools)	*n* = 4762 pass = 2476 (57 schools)	*n* = 37791 pass = 12729 (116 schools)

Table 3 (continued)

	MATHEMATICS			SCIENCE		
	Elementary Schools	Middle Schools	High Schools	Elementary Schools	Middle Schools	High Schools
White						
2003/04	n = 10257 pass = 7847 (241 schools)	n = 24747 pass = 16068 (198 schools)	n = 20268 pass = 12526 (194 schools)	n = 4354 pass = 1921 (114 schools)	n = 5697 pass = 3576 (57 schools)	n = 12496 pass = 8974 (116 schools)
2004/05	n = 11437 pass = 8950 (245 schools)	n = 27964 pass = 19280 (196 schools)	n = 23855 pass = 14450 (192 schools)	n = 4249 pass = 2253 (114 schools)	n = 5707 pass = 3629 (57 schools)	n = 16275 pass = 10818 (116 schools)
2005/06	n = 20064 pass = 13759 (245 schools)	n = 35201 pass = 21672 (196 schools)	n = 22930 pass = 14368 (192 schools)	n = 4121 pass = 2240 (114 schools)	n = 5457 pass = 3641 (57 schools)	n = 15995 pass = 10755 (116 schools)
African American						
2003/04	n = 4962 pass = 1732 (241 schools)	n = 10517 pass = 2583 (198 schools)	n = 8178 pass = 2234 (194 schools)	n = 1122 pass = 145 (114 schools)	n = 2109 pass = 348 (57 schools)	n = 5215 pass = 2395 (116 schools)
2004/05	n = 5122 pass = 2233 (245 schools)	n = 15262 pass = 3617 (196 schools)	n = 10659 pass = 2356 (192 schools)	n = 1011 pass = 202 (114 schools)	n = 1921 pass = 469 (57 schools)	n = 7516 pass = 2400 (116 schools)
2005/06	n = 4825 pass = 2015 (245 schools)	n = 15947 pass = 3141 (196 schools)	n = 10273 pass = 2817 (192 schools)	n = 886 pass = 255 (114 schools)	n = 2090 pass = 487 (57 schools)	n = 7314 pass = 2736 (116 schools)
Hispanic/Latino						
2002/03	n = 126 pass = 90 (24 schools)	n = 611 pass = 261 (15 schools)	n = 1011 pass = 419 (8 schools)	n = 26 pass = 21 (9 schools)	n = 16 pass = 15 (5 schools)	n = 19 pass = 17 (2 schools)
2003/04	n = 27653 pass = 10027 (241 schools)	n = 45166 pass = 8537 (198 schools)	n = 59563 pass = 20152 (194 schools)	n = 3138 pass = 402 (114 schools)	n = 1152 pass = 434 (57 schools)	n = 22703 pass = 9085 (116 schools)
2004/05	n = 28005 pass = 14540 (245schools)	n = 56823 pass = 12247 (196 schools)	n = 79291 pass = 21548 (192 schools)	n = 3180 pass = 516 (114 schools)	n = 1252 pass = 457 (57 schools)	n = 44911 pass = 9872 (116 schools)
2005/06	n = 28894 pass = 15123 (245 schools)	n = 57472 pass = 13514 (196 schools)	n = 81397 pass = 21666 (192 schools)	n = 3088 pass = 620 (114 schools)	n = 1375 pass = 566 (57 schools)	n = 47921 pass = 10351 (116 schools)
Asian						
2003/04	n = 398 pass = 290 (241 schools)	n = 5369 pass = 3900 (198 schools)	n = 3888 pass = 2161 (194 schools)	n = 248 pass = 119 (114 schools)	n = 443 pass = 231 (57 schools)	n = 2290 pass = 1564 (116 schools)
2004/05	n = 237 pass = 180 (245 schools)	n = 5675 pass = 4408 (196 schools)	n = 4281 pass = 2021 (192 schools)	n = 97 pass = 65 (114 schools)	n = 341 pass = 226 (57 schools)	n = 3574 pass = 2109 (116 schools)
2005/06	n = 459 pass = 347 (245 schools)	n = 6305 pass = 4862 (196 schools)	n = 4352 pass = 2150 (192 schools)	n = 89 pass = 68 (114 schools)	n = 326 pass = 224 (57 schools)	n = 3525 pass = 2178 (116 schools)
Other						
2003/04	n = 844 pass = 370 (241 schools)	n = 2032 pass = 788 (198 schools)	n = 828 pass = 264 (194 schools)	n = 273 pass = 33 (114 schools)	n = 182 pass = 53 (57 schools)	n = 203 pass = 45 (116 schools)
2004/05	n = 735 pass = 401 (245 schools)	n = 2078 pass = 879 (196 schools)	n = 2113 pass = 477 (192 schools)	n = 89 pass = 17 (114 schools)	n = 153 pass = 36 (57 schools)	n = 1341 pass = 277 (116 schools)
2005/06	n = 852 pass = 362 (245 schools)	n = 2083 pass = 710 (196 schools)	n = 1742 pass = 390 (schools)	n = 122 pass = 24 (114 schools)	n = 131 pass = 35 (57 schools)	n = 1366 pass = 378 (116 schools)

Table 3 (continued)

	MATHEMATICS			SCIENCE		
	Elementary Schools	Middle Schools	High Schools	Elementary Schools	Middle Schools	High Schools
Special Education Students						
2003/04	*n* = 3742 pass = 1111 (241 schools)	*n* = 8013 pass = 1257 (198 schools)	*n* = 6754 pass = 991 (194 schools)	*n* = 825 pass = 123 (114 schools)	*n* = 1427 pass = 341 (57 schools)	*n* = 2471 pass = 685 (116 schools)
2004/05	*n* = 3828 pass = 1277 (245 schools)	*n* = 6954 pass = 1251 (196 schools)	*n* = 6447 pass = 1110 (192 schools)	*n* = 576 pass = 121 (114 schools)	*n* = 1304 pass = 246 (57 schools)	*n* = 3892 pass = 647 (116 schools)
Limited English Proficiency Students						
2003/04	*n* = 20830 pass = 6968 (241 schools)	*n* = 32161 pass = 4817 (198 schools)	*n* = 26160 pass = 4229 (194 schools)	*n* = 1629 pass = 97 (114 schools)	*n* = 349 pass = 77 (57 schools)	*n* = 8247 pass = 820 (116 schools)
2004/05	*n* = 23348 pass = 11839 (245 schools)	*n* = 51336 pass = 10777 (196 schools)	*n* = 54002 pass = 7918 (192 schools)	*n* = 2031 pass = 151 (114 schools)	*n* = 347 pass = 100 (57 schools)	*n* = 37586 pass = 3895 (116 schools)
2005/06	*n* = 23501 pass = 11912 (245 schools)	*n* = 35138 pass = 6677 (196 schools)	*n* = 33713 pass = 5076 (192 schools)	*n* = 1794 pass = 217 (114 schools)	*n* = 436 pass = 155 (57 schools)	*n* = 17566 pass = 1332 (116 schools)

Note. *n* = number of students assessed; pass = number of students who "pass" (at or above proficient) the state assessment.

Table 4

Longitudinal School Changes in Mathematics Proficiency

School Year	Percent Proficient Students MSP FOCUS ON MATH YES	 NO	Effect Size (*ES*) of Change MSP FOCUS ON MATH YES	 NO
Elementary Schools			Year 2–Year 3 (2003/04-04/05)	
2003/04	41.39% Students: 37,252 Schools: 160	69.65% 7,157 81	Increase *ES* = +.28	Decrease *ES* = -.08
2004/05	55.53% Students: 38,033 Schools: 160	66.09% 8,490 85	Year 2–Year 4 (2003/04-05/06)	
2005/06	58.95% Students: 39,373 Schools: 160	58.96% 18,204 85	Increase *ES* = +.35	Decrease *ES* = -.22
Middle Schools			Year 2–Year 3 (2003/04-04/05)	
2003/04	28.82% Students: 70,801 Schools: 151	63.95% 19,245 47	Increase *ES* = +.05	Increase *ES* = +.09
2004/05	31.26% Students: 91,366 Schools: 153	68.02% 18,821 43	Year 2–Year 4 (2003/04-05/06)	
2005/06	35.14% Students: 94,908 Schools: 153	59.32% 24,985 43	Increase *ES* = +.14	Decrease *ES* = -.10
High Schools			Year 2–Year 3 (2003/04-04/05)	
2003/04	39.53% Students: 84,574 147	48.37% 10,304 47	Decrease *ES* = -.14	No Change
2004/05	32.89% Students: 112,811 Schools: 145	48.58% 10,036 47	Year 2–Year 4 (2003/04-05/06)	
2005/06	32.44% Students: 114,441 Schools : 145	58.44% 9,647 47	Decrease *ES* = -.15	Increase *ES* = +.20

Table 5

Longitudinal School Changes in Mathematics Proficiency by Gender

Gender	School level	MSP Focus on Math	Percent at or above proficient			Change *Effect Size*	
			Year 2 2003/04	Year 3 2004/05	Year 4 2005/06	Year 2-3	Year 2-4
Males	Elementary	YES	40.73	54.69	57.90	.280	.345
		NO	69.12	65.52	52.68	-.077	-.339
	Middle	YES	28.28	31.15	34.74	.063	.139
		NO	63.69	67.73	45.79	.085	-.362
	High	YES	39.77	33.02	32.40	-.140	-.154
		NO	47.60	46.85	57.89	-.015	.206
Females	Elementary	YES	42.07	56.30	59.68	.286	.354
		NO	70.18	66.69	53.13	-.075	-.353
	Middle	YES	29.36	31.16	35.59	.039	.133
		NO	64.20	68.34	47.24	.087	-.343
	High	YES	39.13	32.57	32.12	-.137	-.146
		NO	49.24	50.38	59.03	.023	.197

Table 6

Longitudinal School Changes in Mathematics Proficiency by Ethnicity

Ethnicity	School level	MSP Focus on Math	Percent at or above proficient			Change *Effect Size*	
			Year 2 2003/04	Year 3 2004/05	Year 4 2005/06	Year 2-3	Year 2-4
White	Elementary	YES	78.96	81.61	83.56	.070	.120
White	Elementary	NO	73.94	74.65	59.92	No change	-.300
White	Middle	YES	60.96	66.5711	69.9493	.120	.190
White	Middle	NO	70.26	73.33	49.56	.070	-.426
White	High	YES	63.60	60.51	61.73	-.064	-.039
White	High	NO	57.10	60.78	65.83	.075	.180
African-American	Elementary	YES	27.64	38.57	45.48	.233	.373
African-American	Elementary	NO	75.46	77.86	12.10	.057	-1.394
African-American	Middle	YES	15.16	17.69	17.69	.068	.152
African-American	Middle	NO	69.99	70.86	8.69	.019	-1.384
African-American	High	YES	25.45	20.82	23.35	-.110	-.049
African-American	High	NO	33.46	28.18	47.02	-.114	.278
Hispanic	Elementary	YES	35.86	52.52	54.17	.337	.370
Hispanic	Elementary	NO	48.73	39.64	30.12	-.183	-.383
Hispanic	Middle	YES	18.31	20.93	23.77	.066	.134
Hispanic	Middle	NO	27.29	33.79	19.33	.141	-.189
Hispanic	High	YES	33.83	27.10	26.20	-.146	-.167
Hispanic	High	NO	33.94	30.67	46.13	-.070	.249
Asian	Elementary	YES	79.08	75.59	80.64	No change	No change
Asian	Elementary	NO	66.83	79.17	52.44	No change	-.2945
Asian	Middle	YES	62.20	66.04	69.18	.080	.147
Asian	Middle	NO	84.44	87.25	83.69	.080	-.021
Asian	High	YES	54.50	45.55	46.05	-.179	-.169
Asian	High	NO	59.73	57.91	69.56	-.037	.206
Race not reported	Elementary	YES	47.60	39.70	63.12	-.167	.306
Race not reported	Elementary	NO	38.46	44.29	98.33	.118	1.545
Race not reported	Middle	YES	37.52	36.34	32.35	-.024	-.109
Race not reported	Middle	NO	38.65	44.36	36.02	.120	-.050
Race not reported	High	YES	50.64	42.30	40.06	-.168	-.213
Race not reported	High	NO	31.48	43.37	42.86	.246	.236
Other	Elementary	YES	41.85	56.35	50.66	.291	.177
Other	Elementary	NO	47.60	49.48	29.23	.038	-.380
Other	Middle	YES	27.11	34.16	37.54	.153	.224
Other	Middle	NO	57.75	61.45	27.65	.075	-.619
Other	High	YES	32.36	22.23	20.91	-.228	-.260
Other	High	NO	29.66	29.41	56.16	No change	.543

Table 7
Longitudinal School Changes in Mathematics Proficiency for Special Education and Limited English Proficiency Students

Special education and LEP	School level	MSP Focus on Math	Percent at or above proficient			Change *Effect Size*	
			Year 2 2003/04	Year 3 2004/05	Year 4 2005/06	Year 2-3	Year 2-4
Special Education	Elementary	YES	25.50	29.69	37.97	.094	.269
		NO	42.29	45.81	25.57	.071	-.356
	Middle	YES	10.39	12.95	16.06	.080	.168
		NO	31.21	31.23	9.75	No change	-.550
	High	YES	13.94	17.48	17.48	.097	.0165
		NO	17.62	16.20	30.71	No change	.3083
Limited English Proficiency	Elementary	YES	33.34	51.39	52.24	.367	.384
		NO	38.66	27.70	16.92	-.234	-.494
	Middle	YES	14.49	20.82	19.22	.167	.127
		NO	22.72	25.83	15.12	.072	-.195
	High	YES	15.74	14.48	14.56	-.035	-.0328
		NO	28.33	25.61	36.70	No change	.179

Table 8

Longitudinal School Changes in Science Proficiency

School Year	Percent Proficient Students		Effect Size (*ES*) of Change	
	MSP FOCUS ON SCIENCE		MSP FOCUS ON SCIENCE	
	YES	NO	YES	NO
Elementary Schools			Year 2–Year 3 (2003/04-04/05)	
2003/04	23.28% Students: 7,696 Schools: 96	55.49% 1,721 18	Increase *ES* = +.16	No Change
2004/05	30.33% Students: 7,678 Schools: 96	57.96% 1,658 18	Year 2–Year 4 (2003/04-05/06)	
2005/06	33.39% Students: 7,473 Schools: 96	58.96% 1,592 18	Increase *ES* = +.22	Increase *ES* = +.13
Middle Schools			Year 2–Year 3 (2003/04-04/05)	
2003/04	44.43% Students: 9,679 Schools: 51	68.52% 1,420 6	No Change	Increase *ES* = +.14
2004/05	45.09% Students: 9,430 Schools: 51	74.64% 1,443 6	Year 2–Year 4 (2003/04-05/06)	
2005/06	48.48% Students: 9,299 Schools: 51	66.99% 1,451 6	Increase *ES* = +.08	No Change
High schools			Year 2–Year 3 (2003/04-04/05)	
2003/04	49.50% Students: 41,638 Schools: 104	77.22% 2,854 12	Decrease *ES* = -.36	Increase *ES* = +.11
2004/05	31.99% Students: 71,083 Schools: 104	81.62% 4,135 12	Year 2–Year 4 (2003/04-05/06)	
2005/06	32.07% Students: 73,709 Schools : 104	82.78% 4,123 12	Decrease *ES* = -.36	Increase *ES* = +.14

Table 9

Longitudinal School Changes in Science Proficiency by Gender

Gender	School level	MSP Focus on Science	Percent at or above proficient			Change *Effect Size*	
			Year 2 2003/04	Year 3 2004/05	Year 4 2005/06	Year 2-3	Year 2-4
Males	Elementary	YES	22.56	29.52	31.78	.159	.208
		NO	56.19	59.33	64.35	.064	.167
	Middle	YES	44.95	46.88	50.26	.039	.106
		NO	69.77	74.86	67.36	.114	-.052
	High	YES	50.74	32.82	33.12	-.366	-.359
		NO	76.87	80.38	82.65	.086	.144
Females	Elementary	YES	24.06	30.16	33.75	.138	.214
		NO	54.77	56.48	59.51	.034	.096
	Middle	YES	43.93	46.12	49.53	.044	.112
		NO	67.28	74.42	74.42	.158	No change
	High	YES	48.24	30.93	30.77	-.356	-.360
		NO	77.57	82.86	82.90	.133	.134

Table 10

Longitudinal School Changes in Science Proficiency by Ethnicity

Ethnicity	School level	MSP Focus on Science	Percent at or above proficient			Change *Effect Size*	
			Year 2 2003/04	Year 3 2004/05	Year 4 2005/06	Year 2-3	Year 2-4
White	Elementary	YES	35.01	45.35	47.20	.210	.250
		NO	81.91	85.84	86.53	.107	.127
	Middle	YES	57.95	57.91	62.18	No change	.0864
		NO	93.63	93.63	90.00	No change	-.133
	High	YES	69.26	61.76	62.55	-.158	-.142
		NO	90.72	91.35	91.42	No change	No change
African-American	Elementary	YES	6.34	13.37	22.14	.240	.471
		NO	42.03	47.45	50.98	.109	.180
	Middle	YES	15.84	22.00	23.50	23.500	.193
		NO	19.26	34.21	22.49	.340	No change
	High	YES	40.24	24.57	30.46	-.337	-.205
		NO	62.4251	63.7845	66.7620	No change	.091
Hispanic	Elementary	YES	11.41	15.08	17.89	.108	.184
		NO	19.00	21.29	30.04	No change	.258
	Middle	YES	37.31	35.88	41.46	No change	.085
		NO	43.06	46.05	36.96	No change	No change
	High	YES	40.00	21.94	21.56	-.394	-.404
		NO	64.70	79.41	73.53	No change	No change
Asian	Elementary	YES	35.46	47.50	56.00	.250	.415
		NO	76.32	80.70	84.38	No change	No change
	Middle	YES	49.74	62.50	67.16	.258	.355
		NO	69.09	81.16	76.36	No change	No change
	High	YES	68.30	58.42	61.21	-.206	-.149
		NO	66.6667	82.7586	85.5422	No change	No change
Race not reported	Elementary	YES	45.20	33.38	35.80	-.243	-.192
		NO	NO data available				
	Middle	YES	37.59	34.16	38.44	-.072	No change
		NO	NO data available				
	High	YES	47.38	39.67	37.90	-.156	-.192
		NO	NO data	33.3333	75.0000	--	--
Other	Elementary	YES	9.96	14.47	14.15	No change	No change
		NO	58.33	46.15	56.25	No change	No change
	Middle	YES	28.81	20.98	25.40	No change	No change
		NO	40.00	60.00	60.00	No change	No change
	High	YES	21.10	20.14	20.14	No change	.148
		NO	75.00	90.00	100.0	No change	No change

Table 11

Longitudinal School Changes in Science Proficiency for Special Education and Limited English Proficiency Students

Special education and LEP	School level	MSP Focus on Science	Percent at or above proficient			Change *Effect Size*	
			Year 2 2003/04	Year 3 2004/05	Year 4 2005/06	Year 2-3	Year 2-4
Special Education	Elementary	YES	10.44	13.20	17.67	No change	.210
		NO	.1485	37.91	44.14	No change	.281
	Middle	YES	32.20	23.08	60.00	No change	.565
		NO	38.56	41.57	33.86	No change	No change
	High	YES	27.71	15.65	15.48	-.295	-.300
		NO	27.84	33.98	33.98	No change	.3575
Limited English Proficiency	Elementary	YES	4.69	6.19	10.23	.066	.214
		NO	11.85	14.52	23.08	No change	.299
	Middle	YES	20.00	29.54	33.42	.222	.305
		NO	32.20	23.08	60.00	No change	.565
	High	YES	9.95	10.35	7.57	No change	-.084
		NO	NO data	60.00	33.33	NO data	NO data

Table 12

Growth Trajectories of Schools in Math and Science Proficiency Across Three Years 2003/04-2005/06) – Relationships Between Initial Status of School Proficiency, Rate of Change, and MSP Focus on Math (or Science)

Subject/School level	Tests of Model Fit			Parameter Estimates		
	CFI	TFI	SRMR	Initial Status on MSP Focus	Rate of Change on MSP Focus	Initial Status correlated with Rate of Change
MATH Elementary schools	.844	.833	.079	0.33*	-0.04	-0.30
MATH Middle schools	.959	.876	.035	-1.46**	0.25*	-.53*
MATH High schools	.976	.927	.032	0.37*	-0.01	0.09
SCIENCE Elementary schools	.977	.932	.026	-1.63**	0.01	0.01
SCIENCE Middle schools	.963	.888	.105	-1.27	0.35*	-0.17
SCIENCE High schools	0.999	0.999	.041	-0.56	-0.35	0.25*

Note. * $p < .05$; ** $p < .01$.

Table 13
Correlations Between Teacher Participation in MSP Activities Across Three Years (2003/04, 2004/05, 2005/06) and Student Proficiency at the End Year (2005/06)

Subject/ School level	*r*	*N*	*n*
Mathematics			
Elementary	.093*	498	109,981
Middle	.149*	293	230,525
High	.241**	286	162,342
Science			
Elementary	.105	210	18,292
Middle	.027	209	67,629
High	.473**	188	101,692

Note. N = number of schools (used for the calculation of the correlation coefficient, r); n = number of students who have taken the state assessment in these schools; *$p < .05$, ** $p < .01$.

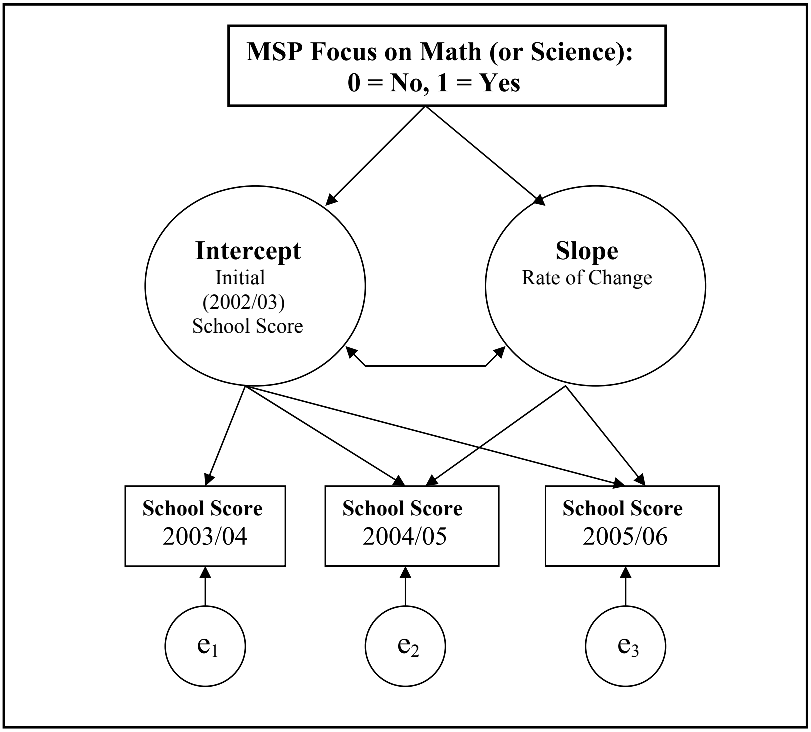


Figure 1. Longitudinal growth model of changes in school math and science proficiency across three years (2003/04-2005/06).

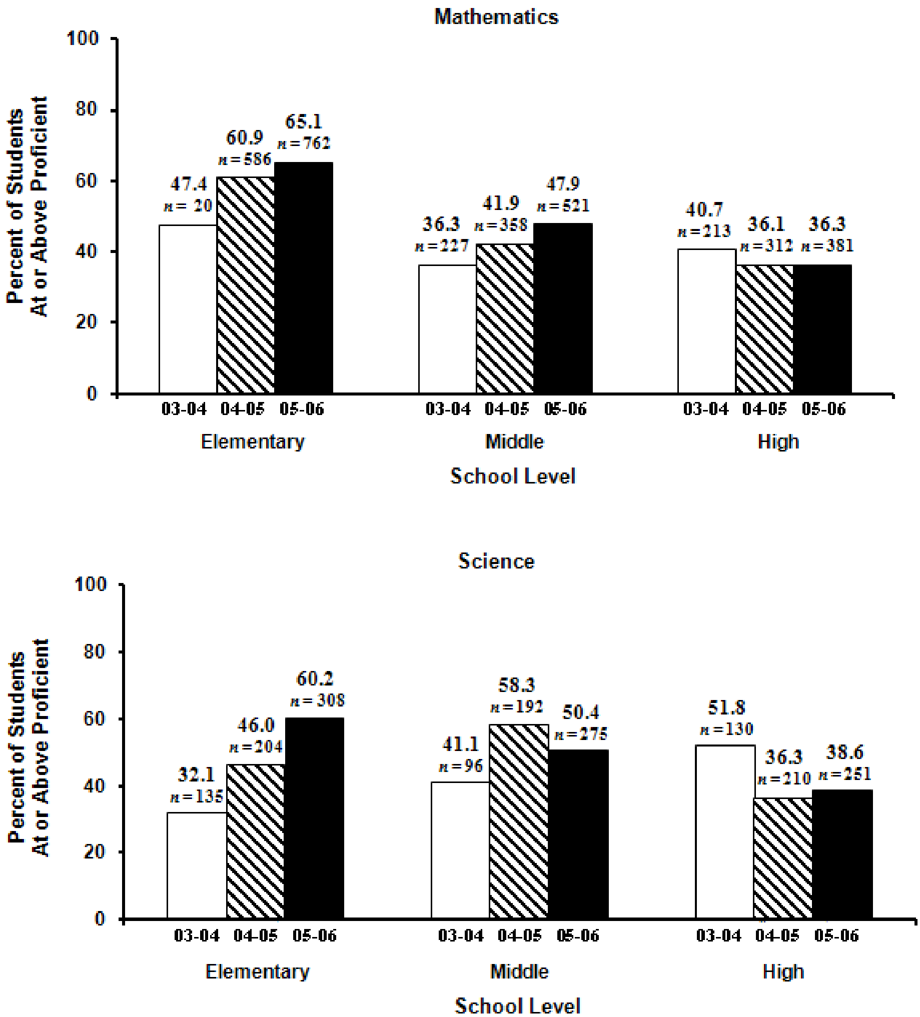
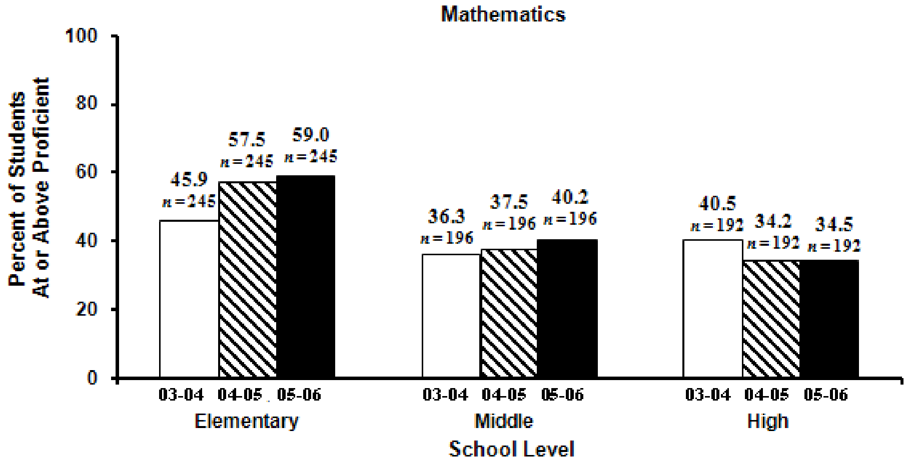


Figure 2. Bar-graphs for achievement trends (percent of students at or above proficient) for schools that have reported data for any of the three years: 2003/04, 2004/05, and 2005/06.



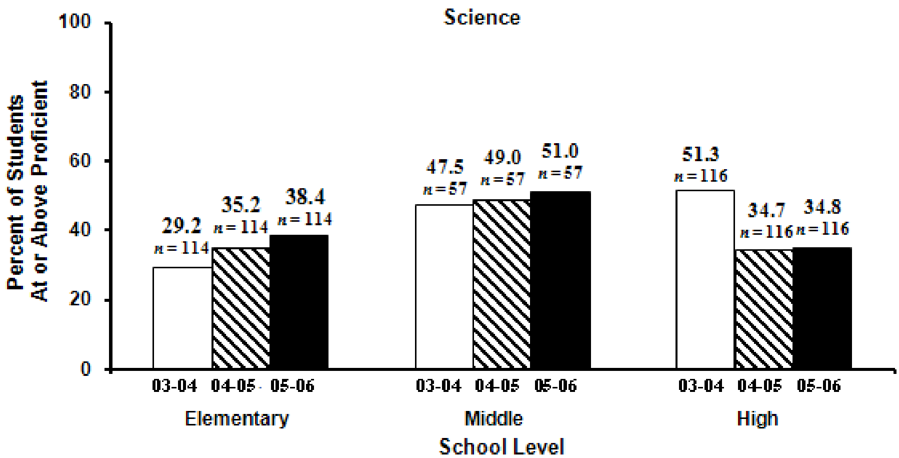
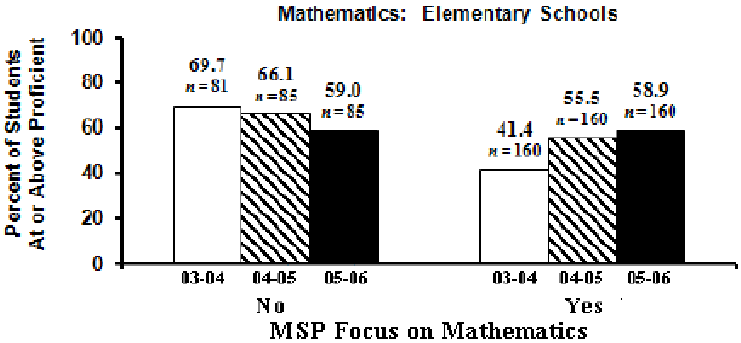
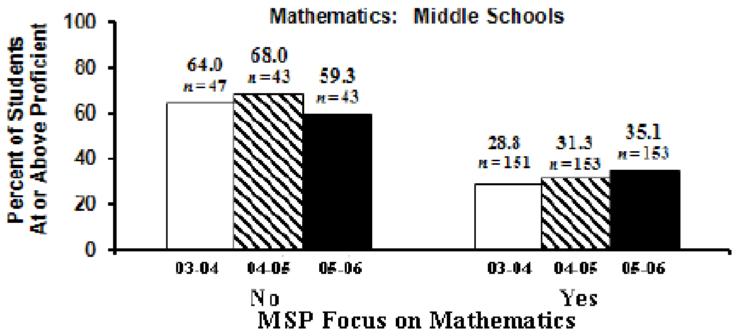


Figure 3. Bar-graphs for achievement trends (percent of students at or above proficient) for schools that have reported data for each of the three years: 2003/04, 2004/05, and 2005/06.





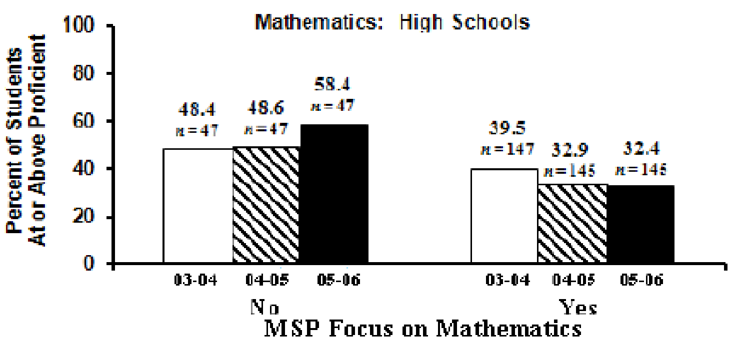


Figure 4. MSPs' focus on mathematics ("No" or "Yes"): Achievement trends for schools reporting data all three years (2003/04, 2004/05, and 2005/06).

Notes: 1. "Focus on Mathematics" means that an MSP's activities addressed mathematics at that grade-span in any of the three years, whether also focusing on mathematics at that grade span or not ("Yes" = did focus; "No" = did not focus).

2. Using a 90% confidence interval (CI), the changes in percent of students at or above proficient in mathematics from 2003/04 to 2004/05 (2005/06) were statistically significant except for the change from 2003/04 to 2004/05 for high schools without focus on mathematics. The 90% CI provides a smaller margin of error than a 95% CI and, despite a slight decrease in the level of confidence, increases the chances of detecting changes when they exist.

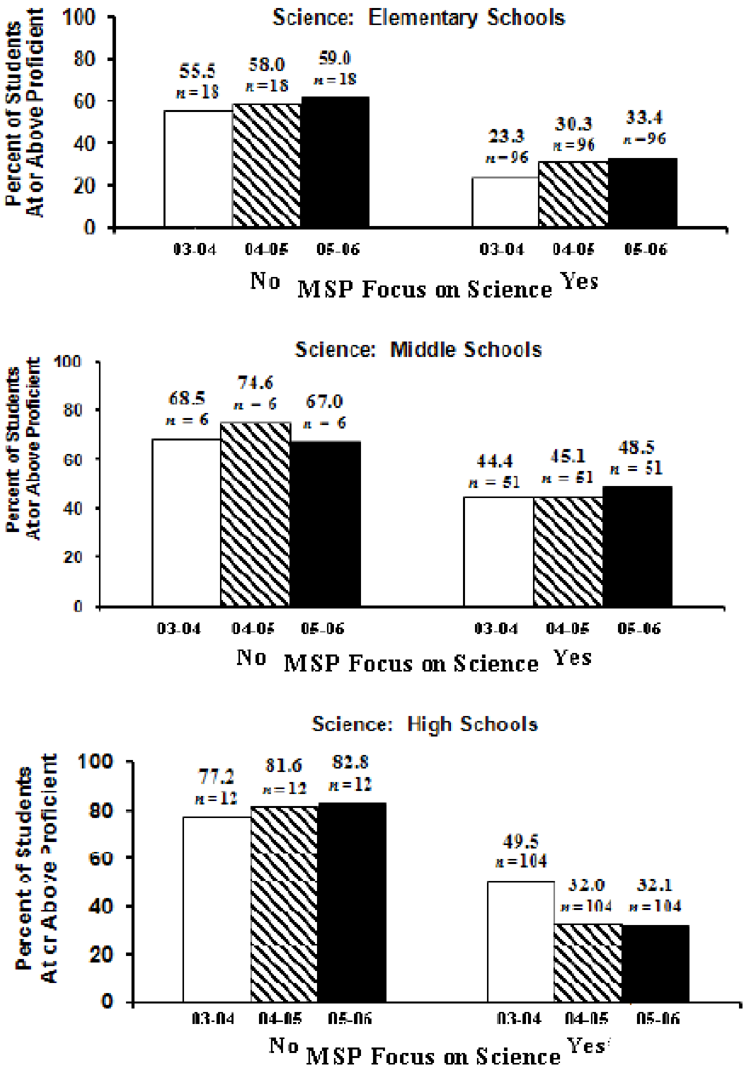


Figure 5. MSPs' focus on science ("No" or "Yes"): Achievement trends for schools reporting data all three years (2003/04, 2004/05, and 2005/06).

Notes: 1. "Focus on Science" means that an MSP's activities addressed science at that grade-span in any of the three years, whether also focusing on science at that grade span or not ("Yes" = did focus; "No" = did not focus).

2. Using a 90% confidence interval (CI), the changes in percent of students at or above proficient in science from 2003/04 to 2004/05 (2005/06) were statistically significant except for (a) from 2003/05 to 2004/05 for elementary schools without focus on science and (b) from 2003/04 to 2004/05 (2005/06) for middle schools regardless of their focus (Yes/No) on science. The 90% CI provides a smaller margin of error than a 95% CI and, despite a slight decrease in the level of confidence, increases the chances of detecting changes when they exist.

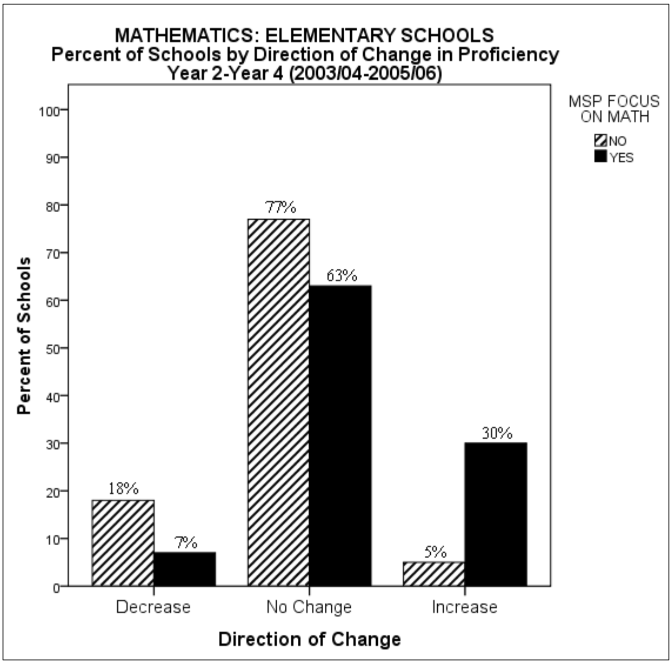


Figure 6. Percent of elementary schools by direction of statistically significant change in proficiency (at or above proficient) in mathematics from 2003/04 to 2005/06.

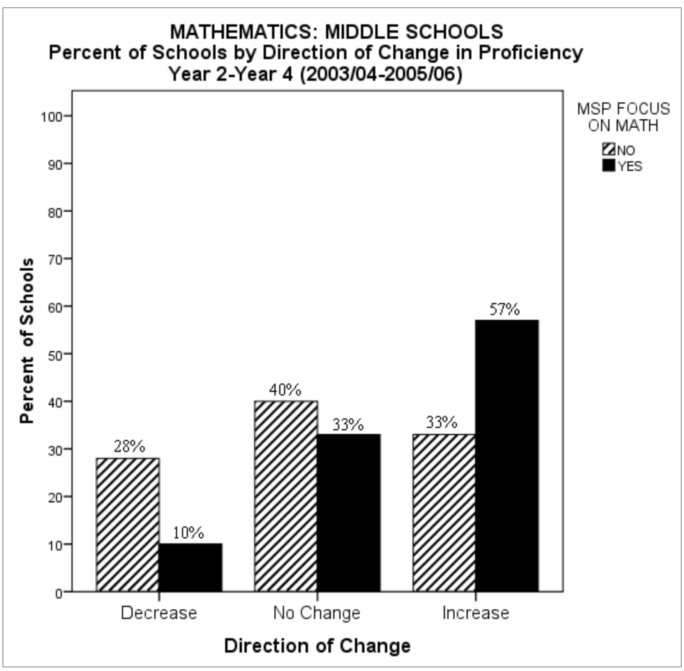


Figure 7. Percent of middle schools by direction of statistically significant change in proficiency (at or above proficient) in mathematics from 2003/04 to 2005/06.

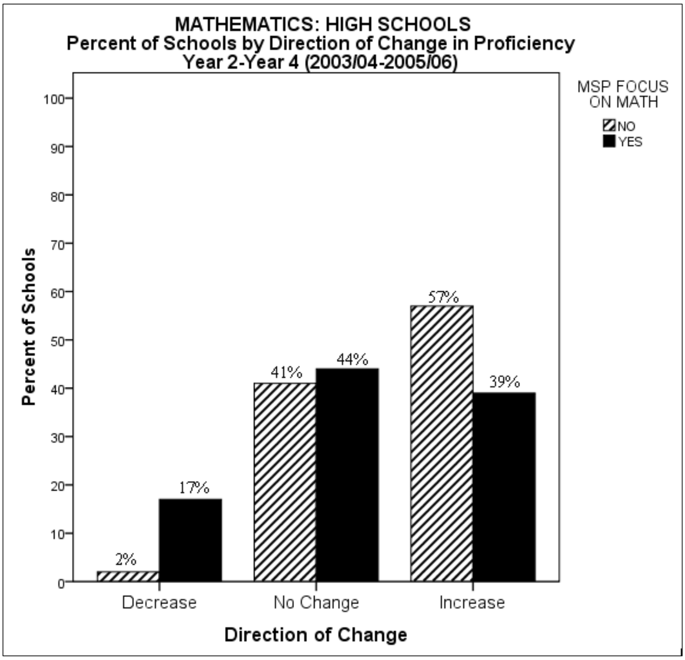


Figure 8. Percent of high schools by direction of statistically significant change in proficiency (at or above proficient) in mathematics from 2003/04 to 2005/06.

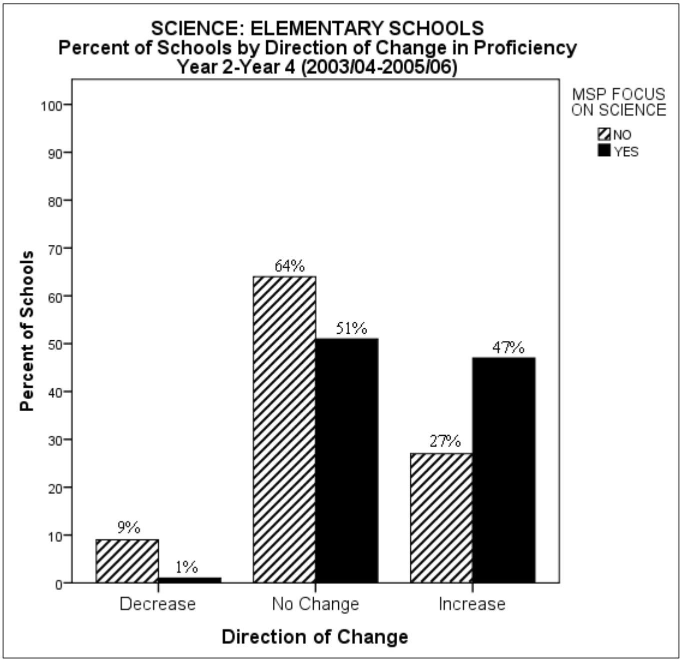


Figure 9. Percent of elementary schools by direction of statistically significant change in proficiency (at or above proficient) in science from 2003/04 to 2005/06.

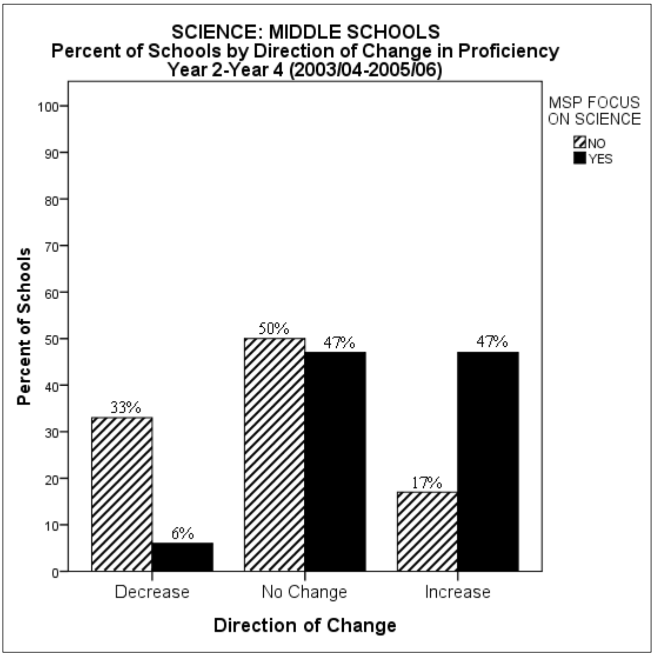


Figure 10. Percent of middle schools by direction of statistically significant change in proficiency (at or above proficient) in science from 2003/04 to 2005/06.

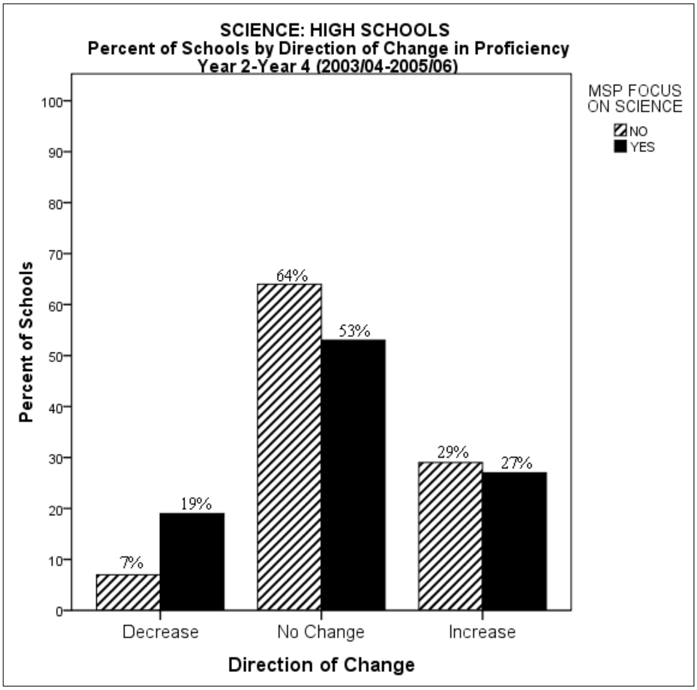


Figure 11. Percent of high schools by direction of statistically significant change in proficiency (at or above proficient) in science from 2003/04 to 2005/06.

Appendix

WORDING OF MSP-MIS QUESTIONNAIRE ITEMS* REFERENCED IN THE PRESENT REPORT

Student Achievement:

Item 7g (2002-04) (Item 11e (2004-05)): Provide the following information about the number of students who took this assessment at [NAME OF SCHOOL] during the [INSERT SCHOOL YEAR] school year:

- *Number of students at this grade level taking assessment during the [INSERT SCHOOL YEAR] school year*
- *Number of students taking assessment and scoring at or above proficient level*

School Participation in MSP Activities (categorical response):

Item A (2002-05): Which of the following conditions apply to this school? **(*check all that apply*)**

- *30 percent or more of targeted teachers participated in 30 or more hours of MSP-sponsored activities during the [INSERT SCHOOL YEAR] school year*
- *30 percent or more of targeted students were engaged in a challenging mathematics or science curriculum that was initiated or revised with MSP support during the [INSERT SCHOOL YEAR] school year*
- *30 percent or more of targeted students participated in a MSP-supported academic enrichment activity during the [INSERT SCHOOL YEAR] school year*
- *None of the above conditions apply to this school for the [INSERT SCHOOL YEAR] school year*

School Participation in MSP Activities (*numeric response*):

Item 1 (2002-05): Provide the following information about the TOTAL number of teachers in [NAME OF SCHOOL] at the beginning of the [INSERT SCHOOL YEAR] school year:

Item 2 (2002-04) (Item 5 (2004-05)): Using the definition for "participating teachers" below, provide the following information about the number of teachers in [NAME OF SCHOOL] that actively participated in your MSP during the [INSERT SCHOOL YEAR] school year:

Definition for "participating teachers": Those teachers who have participated in 30 or more hours of MSP-sponsored activities during a given school year. Examples include teachers who: 1) developed or delivered an MSP-sponsored activity to K-12 students or other teachers; 2) participated in an MSP-sponsored effort to revise math or science curriculum; 3) received MSP-sponsored professional development; and/or 4) took part in MSP-related learning communities.

- *[Number of] math teachers*
- *[Number of] science teachers*

***** All items are from the instrument, *K-12 District Survey for Comprehensive and Targeted MSPs* (some item numbers changed from year-to-year).