National Science Foundation
Math and Science Partnership Program Evaluation (MSP-PE)

Longitudinal Trends in Math and Science Partnership-Related Changes in Student Achievement with Management Information System Data

DRAFT

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May 31, 2009

The present draft is based on materials, information, and data that were available to the author as of December 2008.

PREFACE

This study is one in a series of briefs for the Math and Science Partnership Program Evaluation (MSP-PE), conducted for the National Science Foundation's Math and Science Partnership Program (NSF-MSP). The MSP-PE is conducted under Contract No. EHR-0456995. Since 2007, Bernice Anderson, Ed.D., Senior Advisor for Evaluation, Directorate for Education and Human Resources, has served as the NSF Program Officer. The author is Dimiter M. Dimitrov, Ph.D., of George Mason University.

The MSP-PE is led by COSMOS Corporation. Robert K. Yin (COSMOS) serves as Principal Investigator (PI). Darnella Davis serves as one of three Co-Principal Investigators. Additional Co-Principal Investigators are Kenneth Wong (Brown University) and Patricia Moyer-Packenham (Utah State University).

RUNNING HEAD: Longitudinal Trends in MSP-Related Changes

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

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Abstract

This study is one in a series of substudies for the National Science Foundation's Math and Science Partnership (MSP) Program Evaluation. The study examines student proficiency in math and science for the MSPs' schools in terms of changes across four years (2003/04, 2004/05, 2005/06, and 2006/07) and relationships with MSP-related variables using MSP-Management Information System data from 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 four-year period (2003/04 – 2006/07). The classification of MSP schools *with* and *without* focus on math or science during this time period also was taken into account. The results indicated that the MSP-related schools demonstrate a sustained increase in the percent of students at or above proficient in both math and science at all school levels. This trend was more clearly pronounced for schools *with* focus on math or science. 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 changes in student math and science proficiency. This trend was better pronounced for schools *with* focus on math at the elementary and middle school levels and for schools *with* focus on science at the middle and high school levels. Third, the relationship between the schools' targeted teacher participation in MSP-related activities over the four-year time period (2003/04-2006/07) and the students' math and science proficiency at the "end" year of this period (2006-07) also was investigated. This relationship was positive, yet relatively small, at elementary and high school levels for mathematics, and also positive, yet somewhat better pronounced, at the high school level for science. Fourth, longitudinal growth trajectories in math and science proficiency across the four years also were investigated. The results showed that the schools *with* MSP focus on math (or science) increase at a higher rate in math (or science) proficiency compared to those *without* MSP focus on math (or science) for the elementary and middle schools in math and for the elementary schools in science. It also was found that: (a) relative to the number of students assessed in math (or science), the proportion of teachers participating in MSP-related activities is positively related to the student proficiency in math (or science) at the middle and high school levels for the middle two years of the study time period (2004/05 and 2005/06), and (b) the successful completion of a science course is positively related to the student science proficiency at the high school level.

Longitudinal Trends in MSP-Related Changes in Student Achievement With MIS Data

This study analyzes data from the MSP-Management Information System (MSP-MIS), which was initiated by the National Science Foundation (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 four years (2003/04, 2004/05, 2005/06, and 2006/07) 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 2003/04, 2004/05, 2005/06, and 2006/07. Descriptive analyses from this survey are reported elsewhere (Silverstein et al., 2005). (Another MSP-MIS instrument, the *Annual Survey for Comprehensive and Targeted Partnership Projects*, 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 because the number of schools that provided MIS data for 2002/03 is disproportionately smaller than those in the subsequent four years. For example, the number of schools with MIS data on math performance across all five years, 2002/03-2006/07, versus the number of schools with such data across the last four years, 2003/04-2006/07, is (a) 24 versus 223, for elementary schools, (b) 15 versus 139, for middle schools, and (c) 5 versus 143, for high schools. Also, the initial trends across the first three years, 2002/03-2004/05, are already reported by the MSP-PE (e.g., Dimitrov, 2008).

Addressed are the following six major research questions (RQs):

RQ1: What are the trends in mathematics and science proficiency changes across the targeted four-year time period (2003/04 – 2006/07) for MSP-related schools based on (a) MIS data for all schools that reported student achievement data for any of the four years, and (b) *longitudinal* MIS data — only schools with student achievement data across all four years (2003/04-2006/07). Of particular interest is the effect size in longitudinal changes in student proficiency for schools *with* MSP focus on the subject (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 over the entire four-year period of time (2003/04-2006/07) 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 in math and science proficiency across the four-year period (2003/04 – 2006/07) 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 four-year time period and the schools' success in math and science proficiency at the end year of this time period (2006/07)?

RQ5: What is the relationship between the schools' success in math (or science) proficiency at any year of the time period 2003/04-2006/07 and the "student/teacher ratio" for students who took the state examination in math or science and teachers who actively participated in MSP-related activities during that year?

RQ6: What is the relationship between the schools' success in math (or science) at any year of the time period 2003/04-2006/07 and the ratio indicating what proportion of the students who took the state examination in math (or science) have successfully completed a regular or advanced course in math (or science) that year?

The research questions address different aspects of changes in math or science proficiency for schools *with* (or *without*) MSP focus on math or science across four years (2003/04-2006/07). RQ1 focuses on the statistical significance of changes and their effect size. RQ2 deals with the direction of change (decrease, no change, increase) for schools. RQ3 investigates the trajectories of change across four years (2003/04-2006/07). RQ4 investigates the relationship between school's targeted teacher participation in MSP-related activities over the four-year time period and school's success in math and science proficiency at the end year of this time period (2006/07) **—** that is, whether a "critical mass" of four-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 (2006/07). Finally, RQ5 and RQ6 investigate how the schools' success in math (or science) proficiency relate to (a) the "student/teacher ratio" for students who took the state examination in math or science and teachers who actively participated in MSP-related activities during that year, and (b) the proportion of the students assessed on the state examination in math (or science) who successfully completed a regular or advanced course in math (or science), respectively.

Table 1 summarizes the information about the data used for each research question.

Table 1

Data Sets Used in the Statistical Analysis, by Research Question

Research Question	Data
RQ1: What is the distribution of percent of students at or above proficient in math or science for MSP-related schools over the four-year period of time (2003/04-2006/07) and the effect size of changes in this distribution by 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 years (Appendix A), and (b) using only schools that have reported data across all four years (Appendix B).
RQ2: What is the distribution of MSP-related schools across categories of change (increase, decrease, or no change) in math and science from the first year (2003/04) to the end year (2006/07) by schools *with* or *without* MSP focus on the subject (math or science)?	Longitudinal data from scenario (b) in RQ1 — only schools with MSP-MIS data on student proficiency in math (or science) all four years (Appendix B).
RQ3: What are the longitudinal growth trajectories (initial school performance, rate of change, and interaction between them) in math and science proficiency across the four-year period (2003/04 – 2006/07) for schools *with* MSP focus on the subject (math or science) and schools *without* MSP focus on the subject?	Data used in RQ2 and scenario (b) of RQ1 — only schools for which MSP-MIS student achievement data were available across all four years (Appendix B). 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 four-year time period and the schools' success in math and science proficiency at the end year of this time period (2006/07)?	Schools with MSP-MIS data available on (a) targeted teacher participation at any of the four years (2003/04-2006/07) and (b) student achievement data for the last year of this time period (2006/07).
RQ5: What is the relationship between the schools' success in math (or science) proficiency at any year of the time period 2003/04-2006/07 and the "student/teacher ratio" for students who took the state examination in math or science and teachers who actively participated in MSP-related activities during that year?	Schools for which MSP-MIS data were available at any of the four years (2003/04-2006/07) on (a) the number of students who took the state examinations in math (or science), (b) the number of students at or above proficient on the state examination in math (or science), and (c) the number of math (or science) teachers who actively participated in MSP-related activities during the school year.
RQ6: What is the relationship between the schools' success in math (or science) proficiency at any year of the time period 2003/04-2006/07 and the ratio indicating what proportion of the students who took the state examination in math (or science) have successfully completed a regular or advanced course in math (or science) that year?	High schools for which MSP-MIS data are available at any of the four years (2003/04-2006/07) on (a) student proficiency on state examinations in math (or science) and (b) the proportion of students being assessed on the state examination in math (or science) who have successfully completed a regular or advanced course in math (or science).

The first research question (RQ1) was addressed using MSP-MIS student achievement data from MSP-related schools in two scenarios. Namely (a) using schools that have reported such data for any of the four years 2003/04, 2004/05, 2005/06, and 2006/07 (see Appendix A), and (b) using only schools that have reported data for each of these four years and taking into account the school's focus on math or science (see Appendix B). The first scenario data (Appendix A) are used only for descriptive purposes, whereas the second scenario data (Appendix B) are used for inferential analysis of changes in school math and science proficiency, including effect sizes for changes of particular interest in this study — specifically, changes in the last two years (2005/06-2006/07) and "sustained" changes from the first year (2003/04) to the end year (2006/07) of the four-year time period (2003/04-2006/07).

The second research question (RQ2) was addressed using the longitudinal data from scenario (b) in RQ1 — only schools with MSP-MIS data on student proficiency in math (or science) for all four years (Appendix B). 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 for schools *with* MSP focus on the subject (math or science) and schools *without* MSP focus on the subject over the entire four-year period of time (2003/04-2006/07).

The third research question (RQ3) also was addressed with the data used in RQ2 and scenario (b) of RQ1 — only schools for which MSP-MIS student achievement data were available across all four years (Appendix B). The school scores in this longitudinal analysis were transformed into weighted logit scores to take into account the school's sample size and score variation. Specifically, if P is the school's proportion of students at or above proficient in math or science (out of N students in that school), the *logit score* for the school is the *natural logarithm of the odds* for student proficiency in math (or science): $\log(\text{odds}) = \log(P/(1-P))$. To account for heteroskedastic errors, the logit scores were weighted by using the weights: $W = N*P*(1-P)$.

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. 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).

The fourth research question (RQ4) was addressed using schools for which MSP-MIS data were available on (a) targeted teacher participation at any of the four years (2003/04-2006/07) and (b) student achievement data for the last year (2006/07). 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 four years and student math and science proficiency at the end of this time period. The variable "targeted teacher participation in MSP-related activities" is not involved in the previous three research questions.

The fifth research question (RQ5) was addressed using schools for which MSP-MIS data were available at any of the four years (2003/04-2006/07) on (a) the number of students who took the state examination in math (or science), as well as the number of those who passed the examination, and (b) the number of math (or science) teachers who actively participated in MSP-related activities of the school.

Finally, the sixth research (RQ6) was addressed using schools for which MSP-MIS data were available at any of the four years (2003/04-2006/07) on (a) the number of students who took the state examination in math (or science), as well as the number of those who passed the examination, and (b) the number of students who have successfully completed a regular or advanced course in math (or science). Such MIS data are available only at the high school level.

Method

Data

From the *Annual K-12 District Survey*, the data used in this paper covered schools with available data for the six research questions as described in the previous section. Appendix A provides data on (a) number of schools for which MSP-MIS data on student math or science proficiency were available for any of the four years (2003/04, 2004/05, 2005/06, and 2006/07), (b) number of students in these schools who had taken the state assessment in math or science, and (c) 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. The examination of the data in Appendix A shows, for example, that the highest relative sample representation of schools is for mathematics at the elementary school level. Appendix B is the longitudinal counterparts of Appendix A for math and science, respectively—only schools with MSP-MIS student achievement data across all four years (2003/04-2006/07).

Variables and Scales

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

● 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;

● *Targeted teacher participation in MSP-related activities* — this variable is identified in the 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 four school years (2003/04, 2004/05, 2005/06, and 2006/07) may vary from zero to four (0 = the condition was not met during any of the three years, and 4 = the condition was met all four years);

● 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 four years being studied;

● The "student/teacher ratio" for students who took the state examination in math (or science) at any of the four years (2003/04, 2004/05, 2005/06, and 2006/07) and math (or science) teachers who actively participated in MSP-related activities of the school that year; and

● The proportion of students assessed on the state proficiency examination in math (or science) at any of the four years (2003/04, 2004/05, 2005/06, and 2006/07) who have successfully completed a regular or advanced course in math (or science) that year.

Statistical Analysis

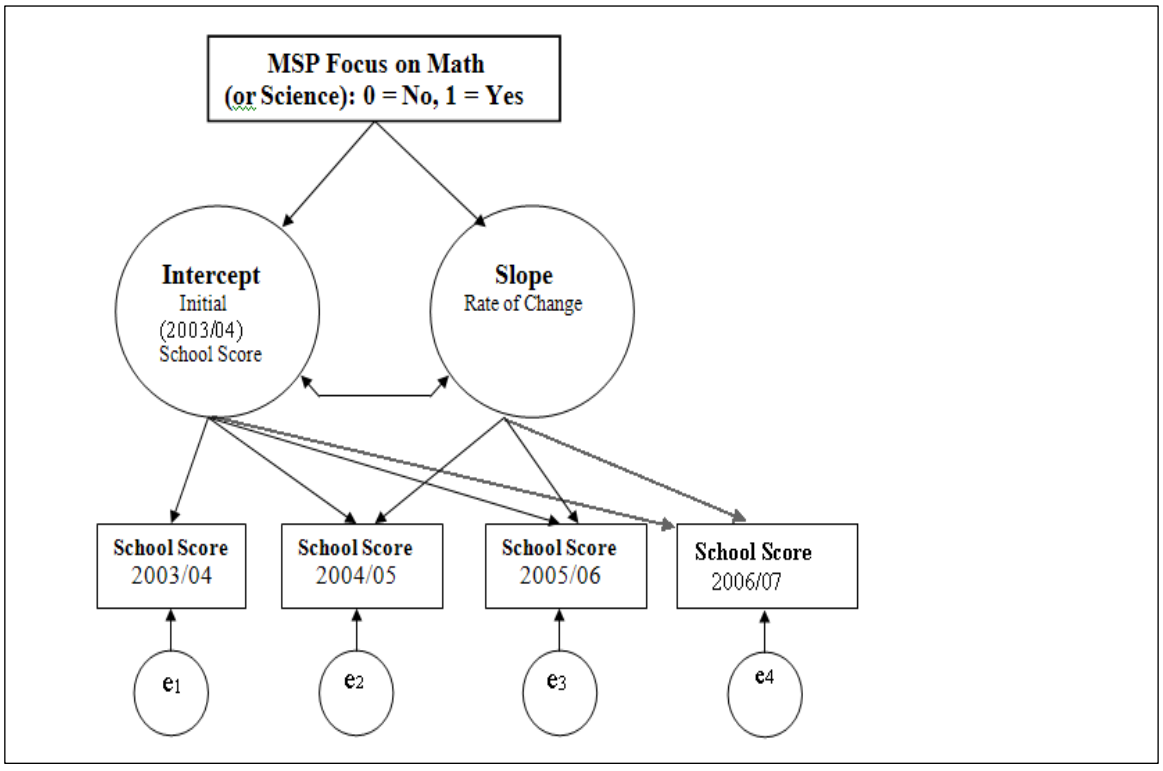
All research questions were addressed by school level (elementary, middle, and high school). To address RQ1, longitudinal analyses were conducted to compare schools with an MSP focus on math (or science) versus schools without such focus on trends and effect size of changes in percent of students at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

significant positive change, (b) *decrease*, if the school has a statistically significant negative change, and (c) *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* were measured by the differences in percent of students at or above proficient on state assessments in mathematics and science (a) from 2005/06 to 2006/07 — last two-year change, and (b) sustained change from the first year (2003/04) to the end year (2006/07).

To address RQ3, longitudinal growth modeling (LGM; e.g., Muthén, 2004) was used 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 four years (2003/04-2006/07). The individual schools were the units of analysis and the weighted logit score of the school proportion of students at or above proficient was the outcome variable measured across all four years (2003/04-2006/07). The school variable "MSP focus on math or science" (0 = No, 1 = Yes) was used as a background variable (see 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).

Figure 1. Longitudinal growth model of changes in school math and science proficiency across four years (2003/04-2006/07)



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 four years (2003/04-2006/07) and student math and science proficiency at the end of this time period (2006/07). This analysis was conducted separately for math and science at each (elementary, middle, and high) school level.

To address RQ5, the Pearson product-moment correlation was used to investigate the relationship between student proficiency on the state examination in math (or science) at any of the four years (2003/04-2006/07) and the "student/teacher ratio" for students who took that examination and teachers who actively participated in MSP-related activities during that year.

Finally, to address RQ6, the Pearson product-moment correlation was used to investigate the relationship between student proficiency on the state examination in math (or science) at any of the four years (2003/04-2006/07) and the proportion of students assessed on that examination who have successfully completed a regular or advanced course in math (or science) that year.

Results

The results are reported in six parts representing the six research questions (RQ1, RQ2, RQ3, RQ4, RQ5, and RQ6) 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 question, RQ1: "What are the trends in mathematics and science proficiency changes across the targeted four-year period (2003/04 – 2006/07) for MSP-related schools based on (a) MIS data for all schools that reported student achievement data for any of the four years and (b) *longitudinal* MIS data — only schools with student achievement data for each of the four years (2003/04-2006/07). 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). The change in percent of students at or above proficient in math (or science) is tested for statistical significance using a 95% confidence interval for change.

Mathematics

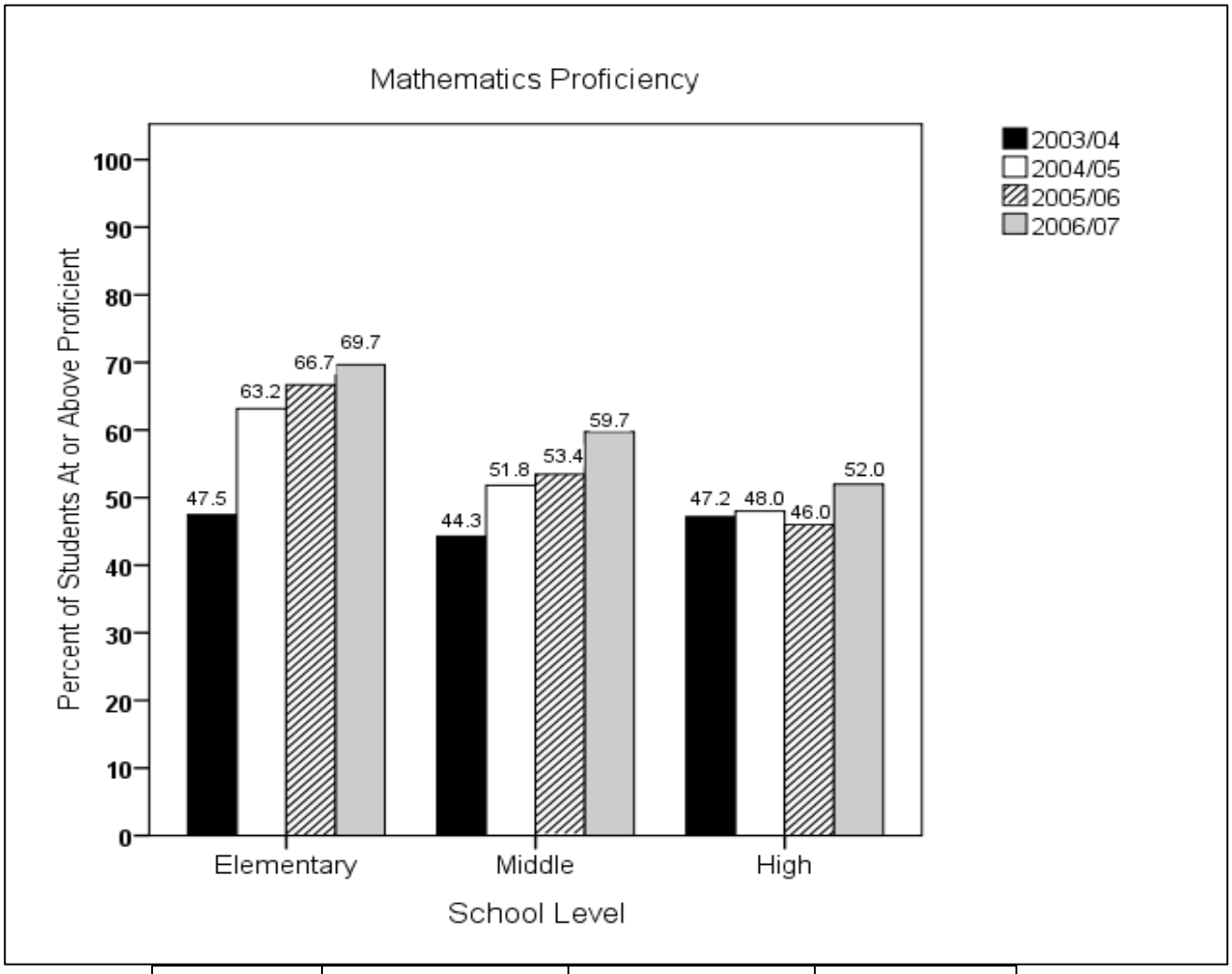
The percent of students at or above proficient on state assessments in mathematics by school level, for all schools with MSP-MIS student achievement data at any of the four years (2003/04-2006/07), was computed from the data in Appendix A (left panel) and presented in Figure 2. As can be seen, there is an increase in math proficiency from the first year (2003/04) to

the end year (2006/07) at all school levels. Also, this sustained (first year – end year) increase in math proficiency was found to be statistically significant at the .05 (or lower) level of significance for the elementary, middle, and high schools. At the intermediate stages, the increase in math proficiency is well sustained at the elementary and middle school levels, but not at the high school level.

The results in Figure 2 are based on the data in Appendix A (left panel), whereas statistical inferences regarding changes in students' math proficiency across school years are based on the data provided in Appendix B (left panel). The results based on these data are reported in Table 2 and Figures 3, 4, and 5 at the elementary, middle, and high school levels, respectively. The results based on data in Appendix B (left panel) by gender, ethnicity, special education, and limited English proficiency are provided in Tables 3, 4, and 5. All results are reported by schools *with* (or *without*) MSP focus on math.

The results for elementary and middle schools in Table 2, graphically represented in Figures 3 and 4, show that while there is some decrease in math proficiency after the first two years for schools *without* MSP focus on math, there is a sustained increase in math proficiency for schools *with* MSP focus on math across all four years (2003/04-2006/07). At the high school level, there is an increase in math proficiency after the first two years for schools *without* MSP focus on math, whereas the math proficiency for schools *with* MSP focus on math is about the same across the first three years and then increases by about three percent at the end year (2006/07) — see Table 2 (lowest panel) and Figure 5. In effect size (*ES*) measures, the largest increase in student math proficiency from the first year (2003/04) to the end year (2006/07) is for schools *with* MSP focus on math at the elementary and middle school levels: *ES* = + .30 and *ES* = +.27, respectively; (a *small to medium* effect size, according to Cohen, 1988, p. 181).

Figure 2. 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 four years (2003/04-2006/07).



School Year	Elementary Schools	Middle Schools	High Schools
2003/04	N = 52926 P = 25119 (318 schools)	N = 71380 P = 31599 (178 schools)	N = 78849 P = 37188 (176 schools)
2004/05	N = 91338 P = 57685 (560 schools)	N = 135891 P = 70442 (297 schools)	N = 110670 P = 53111 (267 schools)
2005/06	N = 158044 P = 105408 (733 schools)	N = 262971 P = 140554 (297 schools)	N = 142323 P = 65452 (338 schools)
2006/07	N = 199853 P = 139222 (801 schools)	N = 278329 P = 166259 (499 schools)	N = 138864 P = 72121 (366 schools)

Note. N = Number of students assessed in math; P = Number of students at or above proficient.
The sustained, first year – end year (2003/04 – 2006/07), increase in math proficiency is statistically significant at the .05 (or lower) level of significance for the elementary, middle, and high schools.

Table 2

Longitudinal School Changes in Mathematics Proficiency for Schools Reporting Data at Each of the Four Years (2003/04-2006/07)

School Level	School Year	Percent of Students At or Above Proficient		*Effect Size* (*ES*) of Change	
		MSP FOCUS ON MATH		MSP FOCUS ON MATH	
		Yes	No	Yes	No
ELEMENTARY	2003/04	**47.06%** Students: 33463 Schools: 135	**64.87%** 8380 88	**Year 3 - Year 4** (2005/06 – 2006/07)	
	2004/05	**56.50%** Students: 33882 Schools: 135	**65.48%** 8733 88	Increase ***ES* = +.08**	Increase ***ES* = +.03**
	2005/06	**58.06%** Students: 35492 Schools: 135	**58.97%** 18544 88	**Year 1 - Year 4** (2003/04 – 2006/07)	
	2006/07	**61.82%** Students: 34763 Schools: 135	**60.39%** 18986 88	Increase ***ES* = +.30**	Decrease ***ES* = -.09**
MIDDLE	2003/04	**37.75%** Students: 43976 Schools: 96	**65.41%** 18297 43	**Year 3 - Year 4** (2005/06 – 2006/07)	
	2004/05	**44.76%** Students: 41348 Schools: 96	**68.02%** 18821 43	Increase ***ES* = +.09**	No Change
	2005/06	**46.83%** Students: 45238 Schools: 96	**59.32%** 24985 43	**Year 1 - Year 4** (2003/04 – 2006/07)	
	2006/07	**51.30%** Students: 46035 Schools: 96	**59.94%** 24370 43	Increase ***ES* = +.27**	Decrease ***ES* = -.11**
HIGH	2003/04	**48.20%** Students: 61632 Schools: 97	**48.41%** 10296 46	**Year 3 - Year 4** (2005/06 – 2006/07)	
	2004/05	**48.65%** Students: 59601 Schools: 97	**48.64%** 10022 46	Increase ***ES* = +.06**	No Change
	2005/06	**48.69%** Students: 58520 Schools: 97	**58.53%** 9633 46	**Year 1 - Year 4** (2003/04 – 2006/07)	
	2006/07	**51.63%** Students: 59527 Schools: 97	**57.50%** 10332 46	Increase ***ES* = +.07**	Increase ***ES* = +.18**

Figure 3. Percent of students at or above proficient on state assessments in mathematics for elementary schools with MSP-MIS student achievement data at each of the four years (2003/04-2006/07).

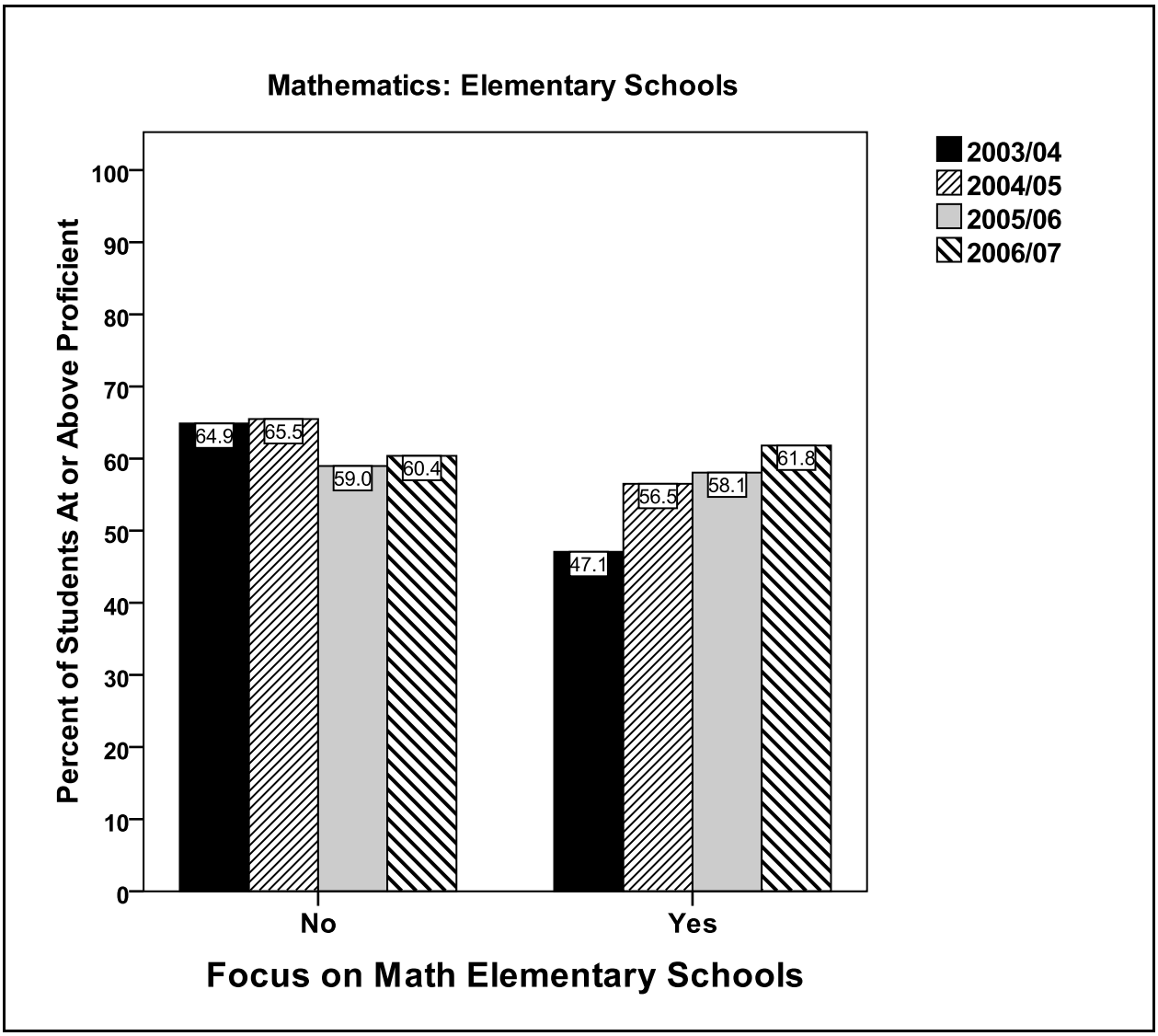


Figure 4. Percent of students at or above proficient on state assessments in mathematics for middle schools with MSP-MIS student achievement data at each of the four years (2003/04-2006/07).

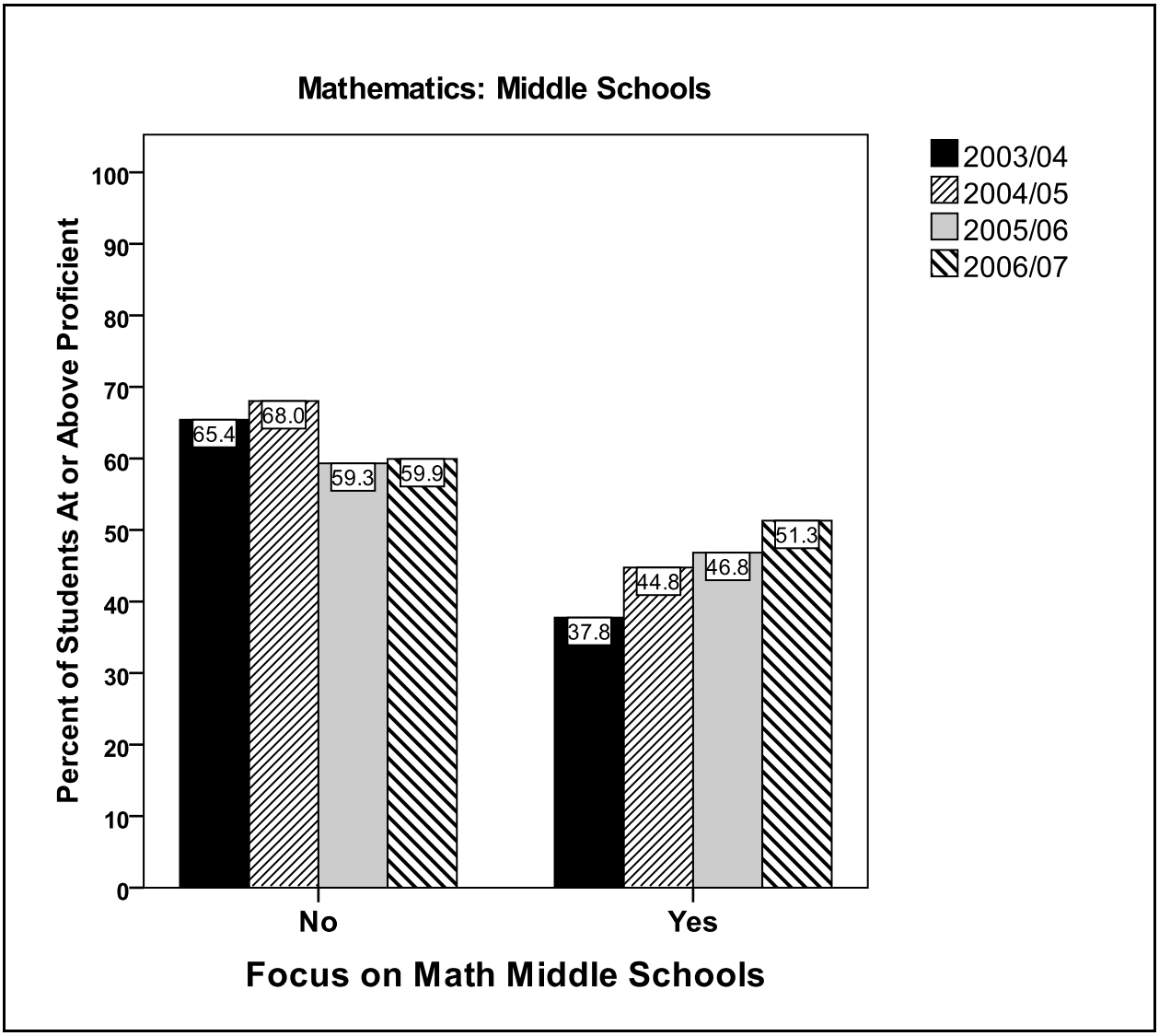
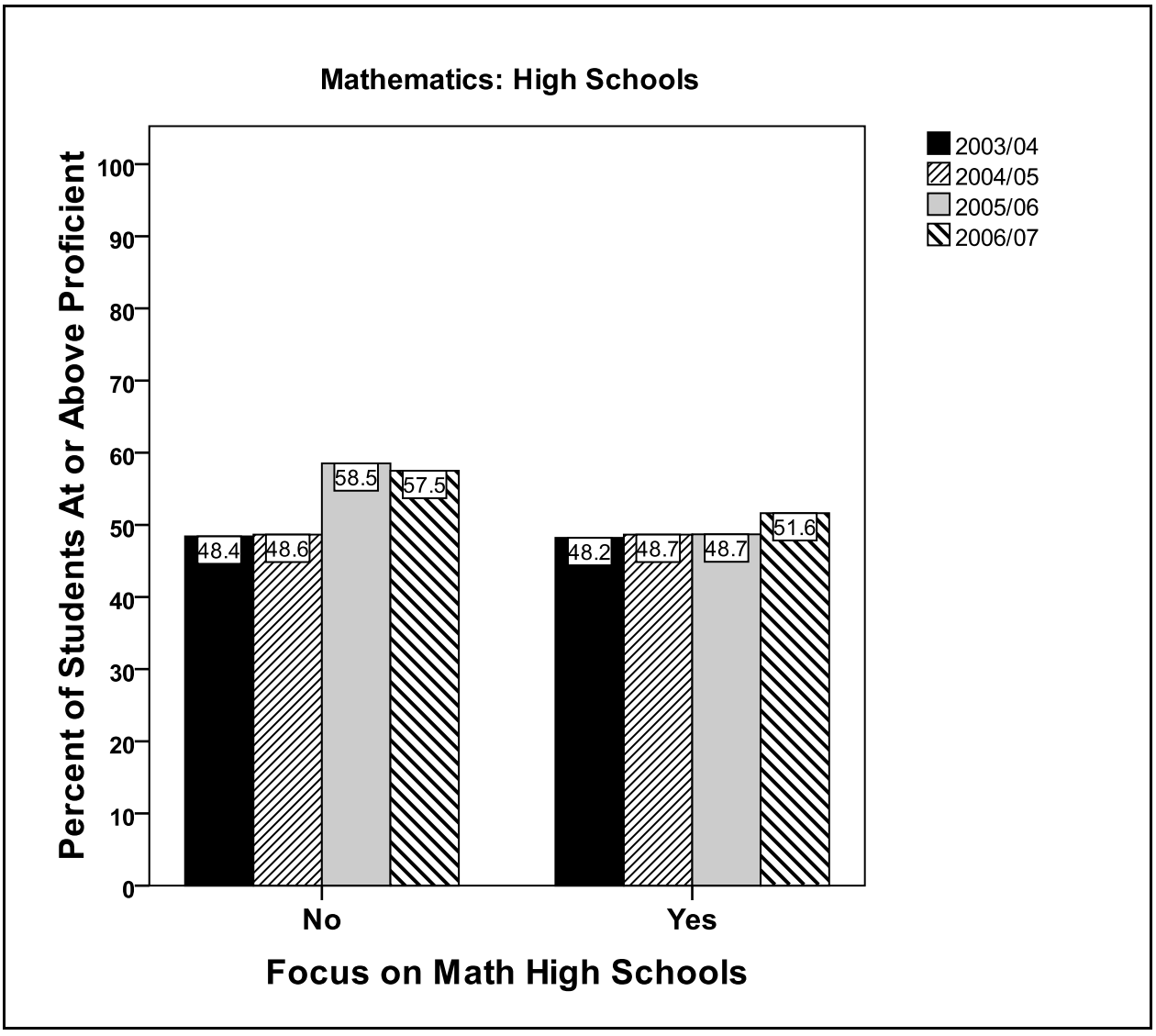


Figure 5. Percent of students at or above proficient on state assessments in mathematics for high schools with MSP-MIS student achievement data at each of the four years (2003/04-2006/07).



By gender, the results in Table 3 for "first year - end year" (2003/04-2006/07) changes show that the largest increase in math proficiency for both males and females is for elementary and middle schools *with* MSP focus on math, with effect sizes of +.28 (males and females in middle schools), +.29 (males in elementary schools), and +.31 (females in elementary schools) compared to a decrease in math proficiency for schools *without* MSP focus on math, with effect sizes of –.15 (males and females in middle schools), –.12 (males in elementary schools), and –.10 (females in elementary schools). At the high school level, both schools *with* and *without* MSP focus on math showed an increase for the "first year - end year" (2003/04-2006/07) time

period, regardless of gender, but the effect size was somewhat larger for schools *without* MSP focus on math.

Table 3

Longitudinal School Changes in Mathematics Proficiency by Gender

Gender	School Level	MSP Focus on Math	Percent at or above proficient				*Effect Size*	
			Year 1 2003/04	**Year 2** 2004/05	**Year 3** 2005/06	**Year 4** 2006/07	**Year 3-Year 4** 2005/06-06/07	**Year 1–Year 4** 2003/04-06/07
Males	Elem.	**Yes**	46.48	55.48	57.32	60.76	+.07	+.29
		No	64.21	65.21	52.88	58.47	+.11	–.12
	Middle	**Yes**	36.8	43.5	46.3	50.7	+.09	+.28
		No	65.1	67.7	45.8	57.9	+.24	–.15
	High	**Yes**	48.9	49.6	49.9	52.7	+.06	+.08
		No	47.7	47.0	58.0	57.8	No change	+.20
Females	Elem.	**Yes**	47.8	56.7	58.8	63.0	+.09	+.31
		No	65.5	66.1	53.2	60.4	+.15	–.10
	Middle	**Yes**	38.7	45.0	48.4	52.5	+.08	+.28
		No	65.7	68.3	47.2	58.4	+.22	–.15
	High	**Yes**	47.2	48.2	48.4	51.8	+.07	+.09
		No	49.3	50.4	59.1	57.2	No change	+.16

By ethnicity, the results in Table 4 show that the largest "first year-end year" (2003/04-2006/07) increase in math proficiency is for African-American students in schools *with* MSP focus on math at the elementary and middle school levels **versus** the largest decrease in math proficiency in schools *without* MSP focus in math for African-American students at these school levels, with effect sizes of +.51 versus –.70 (middle schools) and +.42 versus –.69 (elementary schools). For White and Hispanic students, there is an increase in math proficiency for schools *with* MSP focus on math at all school levels and for schools *without* MSP focus in math at the high school level, whereas there is a decrease in math proficiency for schools *without* MSP focus at the elementary and middle school levels. For Asian students, there are no changes in math proficiency for the "first year-end year" (2003/04-2006/07) time period, most likely due to a "start high–finish high" effect. For "other race" students, there are no changes in math proficiency for this time period at the elementary and high school levels, but there is a change at the middle school level, with an increase for schools *with* MSP focus on math (*ES* = +.14) versus a decrease for schools *without* MSP focus in math (*ES* = –.15).

Table 4

Longitudinal School Changes in Mathematics Proficiency by Ethnicity for Schools Reporting Data at Each of the Four Years (2003/04-2006/07)

Ethnicity	School Level	MSP Focus on Math	Percent at or above proficient				*Effect Size* of Change	
			Year 1 2003/04	Year 2 2004/05	Year 3 2005/06	Year 4 2005/06	Year 3-Year 4 2005/06-06/07	Year 1-Year 4 2003/04-06/07
White	Elem.	**Yes**	77.4	81.7	79.4	81.6	+.06	+.10
		No	72.2	73.7	60.0	67.0	+.15	–.11
	Middle	**Yes**	62.6	70.2	72.1	77.1	+.11	+.32
		No	70.6	73.3	49.6	62.4	+.26	–.17
	High	**Yes**	68.4	71.3	71.6	76.3	+.11	+.18
		No	57.1	60.8	65.8	65.0	No change	+.16
African-American	Elem.	**Yes**	27.0	38.3	45.2	47.2	No change	.42
		No	74.9	77.3	12.1	41.6	+.69	–.69
	Middle	**Yes**	15.6	23.8	25.9	37.6	+.25	+.51
		No	70.0	70.9	8.7	35.9	+.69	–.70
	High	**Yes**	33.4	31.5	33.3	36.5	+.07	+.06
		No	33.6	28.3	47.3	48.7	No change	+.31
Hispanic	Elem.	**Yes**	42.9	52.5	51.8	56.8	+.10	+.28
		No	36.3	39.7	30.2	31.3	No change	–.11
	Middle	**Yes**	29.2	30.9	32.7	34.5	+.04	+.11
		No	29.8	33.8	19.3	24.0	+.11	–.13
	High	**Yes**	44.0	44.4	44.3	47.2	+.06	+.07
		No	33.9	30.7	46.2	46.5	No change	+.26
Asian	Elem.	**Yes**	79.6	75.2	80.3	85.3	No change	No change
		No	66.2	79.2	52.4	57.0	No change	No change
	Middle	**Yes**	69.4	70.0	71.9	69.9	No change	No change
		No	84.4	87.2	83.7	84.8	No change	No change
	High	**Yes**	65.1	57.4	58.3	64.8	+.13	No change
		No	59.7	57.9	69.7	58.8	–.23	No change
Other	Elem.	**Yes**	47.7	58.3	50.5	46.9	No change	No change
		No	46.2	55.4	27.2	45.5	+.38	No change
	Middle	**Yes**	36.5	34.3	40.1	43.4	No change	+.14
		No	49.1	54.2	32.2	41.5	+.19	–.15
	High	**Yes**	44.0	46.7	32.3	45.5	+.27	No change
		No	30.2	13.3	69.6	19.0	–1.07	No change

For special education students, the results in Table 5 show an increase in math proficiency for schools *with* MSP focus on math versus a decrease for schools *without* MSP focus in math at the elementary school level (*ES* = .16 versus *ES* = –.36) and at the middle school level (*ES* = .+36 versus *ES* = –.56). At the high school level, however, there is no change in math proficiency for special education students in schools *with* MSP focus on math versus an increase for schools *without* MSP focus in math (*ES* = +.33).

For students with limited English proficiency, the results (still in Table 5) show an increase in math proficiency for schools *with* MSP focus on math at all school levels — elementary (*ES* = +.24), middle (*ES* = +.18), and high (*ES* = +.11)—as well as for high schools *without* MSP focus

in math (*ES* = +.29). However, there is a decrease in math proficiency for these students in schools *without* MSP focus in math at the elementary and middle school levels (*ES* = –.27 and *ES* = –.74, respectively).

Table 5

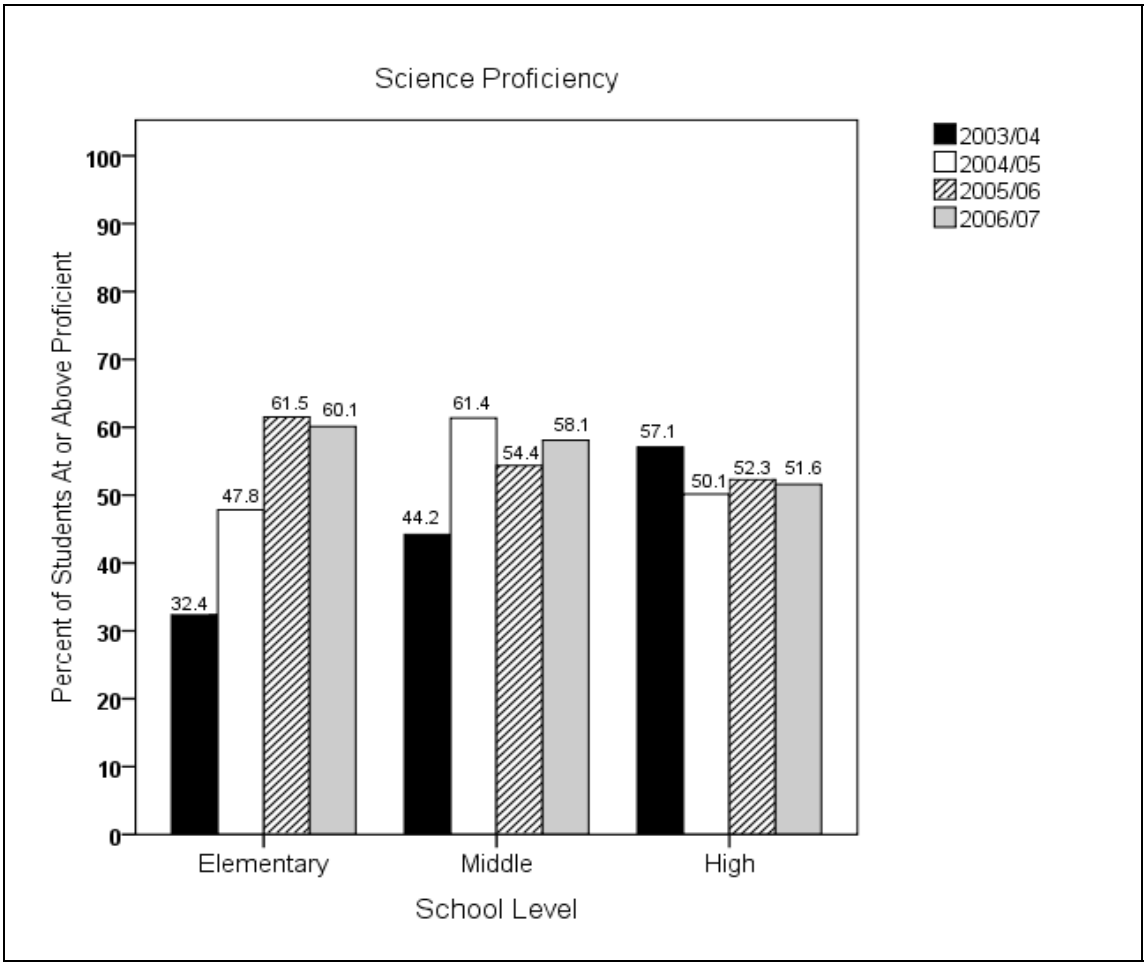
Longitudinal School Changes in Mathematics Proficiency for Special Education (SED) and Limited English Proficiency (LEP) Students for Schools Reporting Data at Each of the Four Years (2003/04-2006/07)

SED LEP	School Level	MSP Focus on Math	Percent at or above proficient				*Effect Size*	
			Year 1 2003/04	Year 2 2004/05	Year 3 2005/06	Year 4 2006/07	Year 3-Year 4 2005/06-06/07	Year 1–Year 4 2003/04-06/07
Special Education Students (SED)	Elem.	**Yes**	32.8	23.9	31.7	40.7	+.19	+.16
		No	40.9	45.9	25.6	24.4	No change	–.36
	Middle	**Yes**	11.4	13.0	19.6	24.8	+.13	+.36
		No	31.3	31.2	9.8	9.5	No change	–.56
	High	**Yes**	17.4	22.6	21.5	19.2	–.06	No change
		No	17.7	16.4	31.1	32.0	No change	+.33
Limited English Proficiency (LEP)	Elem.	**Yes**	42.5	51.3	48.9	54.3	+.11	+.24
		No	24.0	27.7	16.8	13.5	–.09	–.27
	Middle	**Yes**	25.4	27.3	28.3	33.6	+.11	+.18
		No	26.1	25.8	15.1	2.7	–.47	–.74
	High	**Yes**	24.5	28.8	25.5	29.3	+.08	+.11
		No	28.3	25.6	36.7	42.1	+.11	+.29

Science

The percent of students at or above proficient on state assessments in science by school level (elementary, middle, and high) for all schools with MSP-MIS student achievement data at any of the four years (2003/04-2006/07) was computed from the data in Appendix A (right panel) and graphically presented in Figure 6. Regarding the overall change in percent of students at or above proficient in science from first year (2003/04) to the end year (2006/07), there is (a) a sustained and substantial increase of about 30 percent at the elementary school level, (b) an increase of about 14 percent, with some intermediate fluctuations, at the middle school level, and (c) an initial drop of 7 percent followed by a slight increase of 1.5 percent from the second year (2004/05) to the end year (2006/07) at the high school level.

Figure 6. Percent of students at or above proficient on state assessments in science by school level (elementary, middle, and high) for all schools with MSP-MIS student achievement data at any of the four years (2003/04-2006/07).



School Year	Elementary Schools	Middle Schools	High Schools
2003/04	N = 10838 P = 3511 (134 schools)	N = 14458 P = 6389 (66 schools)	N = 39647 P = 22628 (107 schools)
2004/05	N = 16876 P = 8073 (197 schools)	N = 47048 P = 28864 (159 schools)	N = 65960 P = 33076 (230 schools)
2005/06	N = 32817 P = 20187 (301 schools)	N = 79658 P = 43320 (242 schools)	N = 79381 P = 41486 (230 schools)
2006/07	N = 57647 P = 34642 (450 schools)	N = 92347 P = 53637 (320 schools)	N = 91354 P = 47086 (291 schools)

Note. *N* = Number of students assessed in science;
P = Number of students at or above proficient.
All changes in science proficiency from first year (2003/04) to end year (2006/07) —positive at the elementary and middle school levels and negative at the high school level—are statistically significant at the .05 (or lower) level of significance.

The descriptive results in Figure 6 are based on the data in Appendix A (right panel), whereas statistical inferences regarding changes in students' science proficiency across school years are based on the in Appendix B (right panel) — student achievement data provided by schools at each of the four years (2003/04-2006/07). The results based on the data for all students in Appendix B (right panel) are provided in Table 6 and Figures 7, 8, and 9 at the elementary, middle, and high school levels, respectively. The results based on data in Appendix B (right panel) by gender, ethnicity, special education, and limited English proficiency are provided in Tables 7, 8, and 9. All results are reported by schools *with* (or *without*) MSP focus on science.

The results in Table 6, depicted in Figures 7, 8, and 9, show that for the entire four-year time period (2003/04-2006/07), there is a sustained increase in science proficiency for schools *with* MSP focus on science at all school levels, except for an initial drop after the first year (2003/04) at the high school level. For the schools *without* MSP focus on science, there is an increase (*ES* = +.17) from the first year (2003/04) to the end year (2006/07) at the elementary school level, but no change (increase or decrease) at the middle and high school levels. In effect size measures, the largest increase in science proficiency from first year (2003/04) to end year (2006/07) is at the elementary school level (*ES* = +.20, for schools *with* MSP focus on science, and *ES* = +.17 for schools *without* MSP focus on science), followed by the increase in middle schools *with* MSP focus on science (*ES* = +.15), and by the increase in high schools *with* MSP focus on science (*ES* = +.06).

Table 6

Longitudinal School Changes in Science Proficiency for Schools Reporting Data at Each of the Four Years (2003/04-2006/07)

School Level	School Year	Percent of Students At or Above Proficient		*Effect Size* (*ES*) of Change	
		MSP FOCUS ON SCIENCE		MSP FOCUS ON SCIENCE	
		Yes	No	Yes	No
ELEMENTARY	2003/04	**25.35%** Students: 6982 Schools: 84	**55.49%** 1721 18	**Year 3 - Year 4** (2005/06 – 2006/07)	
	2004/05	**31.92%** Students: 6895 Schools: 84	**57.96%** 1658 18	No Change	No Change
	2005/06	**34.34%** Students: 6727 Schools: 84	**61.87%** 1592 18	**Year 1 - Year 4** (2003/04 – 2006/07)	
	2006/07	**34.69%** Students: 6461 Schools: 84	**63.59%** 1623 18	Increase ***ES* = +.20**	Increase ***ES* = +.17**
MIDDLE	2003/04	**43.68%** Students: 6680 Schools: 36	**68.52%** 1420 6	**Year 3 - Year 4** (2005/06 – 2006/07)	
	2004/05	**42.63%** Students: 6883 Schools: 36	**74.64%** 1443 6	Increase ***ES* = +.09**	No Change
	2005/06	**46.59%** Students: 6866 Schools: 36	**66.99%** 1451 6	**Year 1 - Year 4** (2003/04 – 2006/07)	
	2006/07	**51.23%** Students: 6516 Schools: 36	**67.29%** 1330 6	Increase ***ES* = +.15**	No Change
HIGH	2003/04	**55.19%** Students: 35188 Schools: 82	**78.74%** 2441 10	**Year 3 - Year 4** (2005/06 – 2006/07)	
	2004/05	**51.06%** Students: 36479 Schools: 82	**79.88%** 2485 10	Increase ***ES* = +.09**	No Change
	2005/06	**53.69%** Students: 35014 Schools: 82	**82.88%** 2407 10	**Year 1 - Year 4** (2003/04 – 2006/07)	
	2006/07	**58.24%** Students: 33304 Schools: 82	**80.78%** 2659 10	Increase ***ES* = +.06**	No Change

Figure 7. Percent of students at or above proficient on state assessments in mathematics for the elementary schools with MSP-MIS student achievement data at each of the four years (2003/04-2006/07).

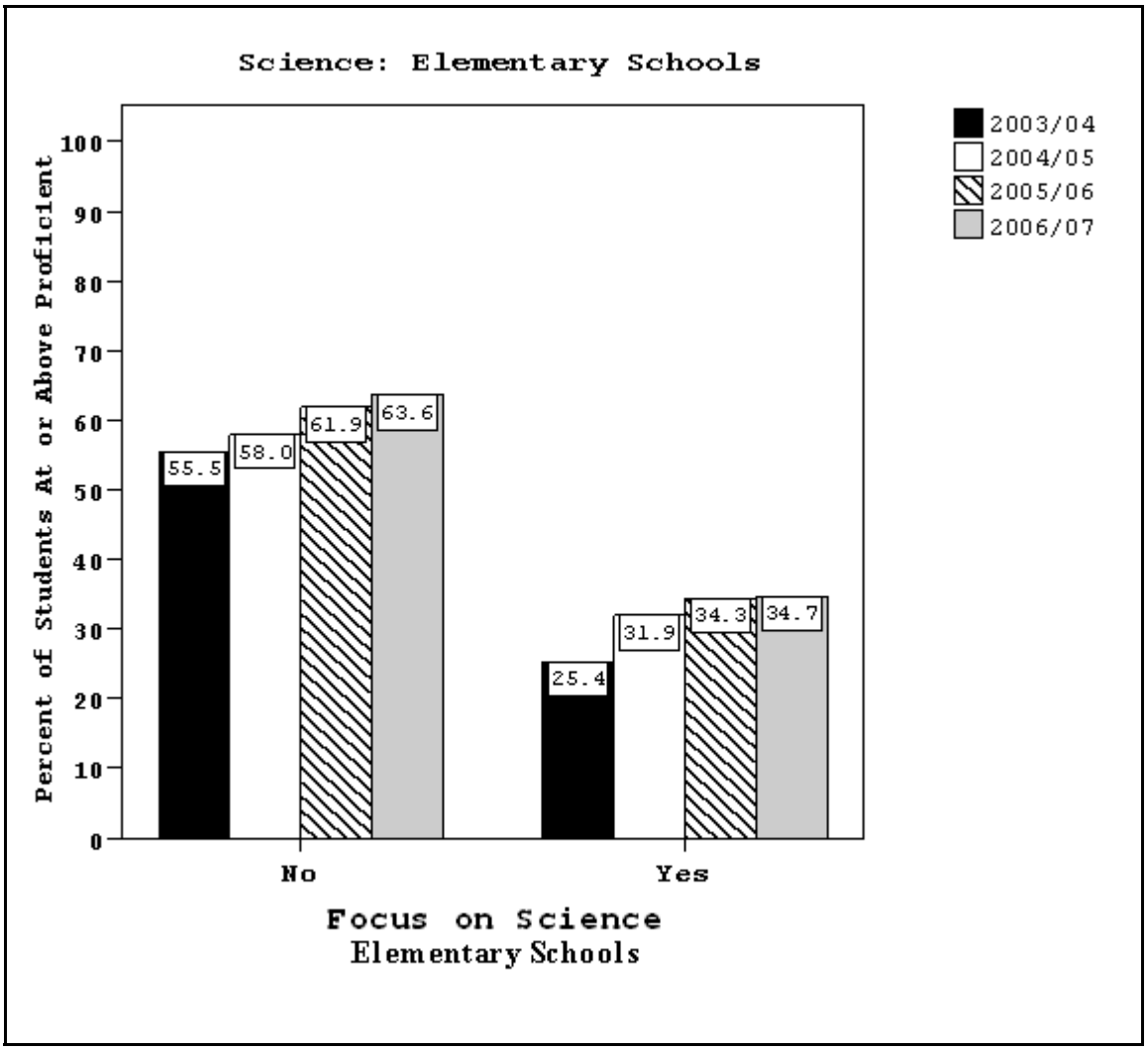


Figure 8. Percent of students at or above proficient on state assessments in mathematics for the middle schools with MSP-MIS student achievement data at each of the four years (2003/04-2006/07).

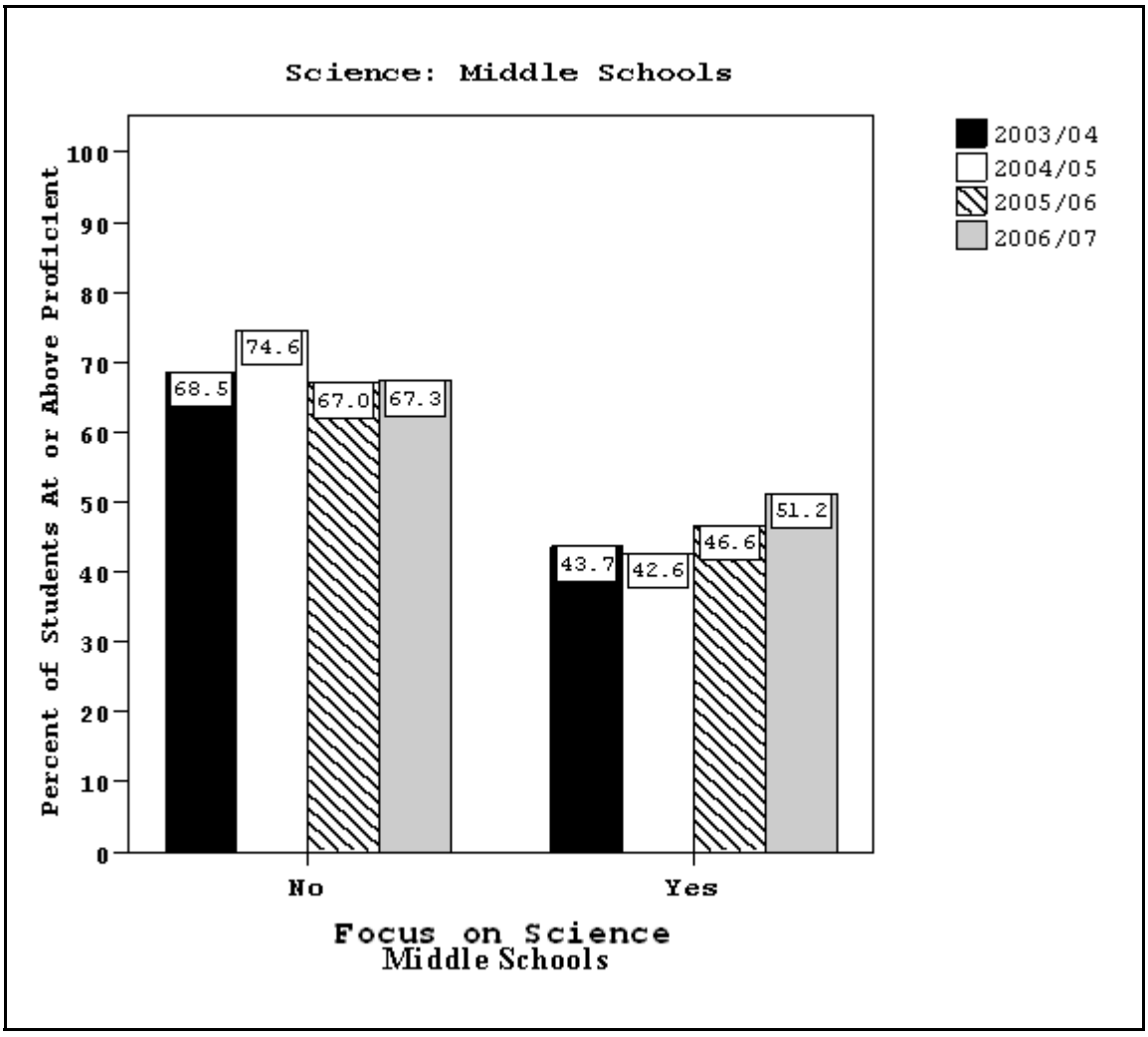
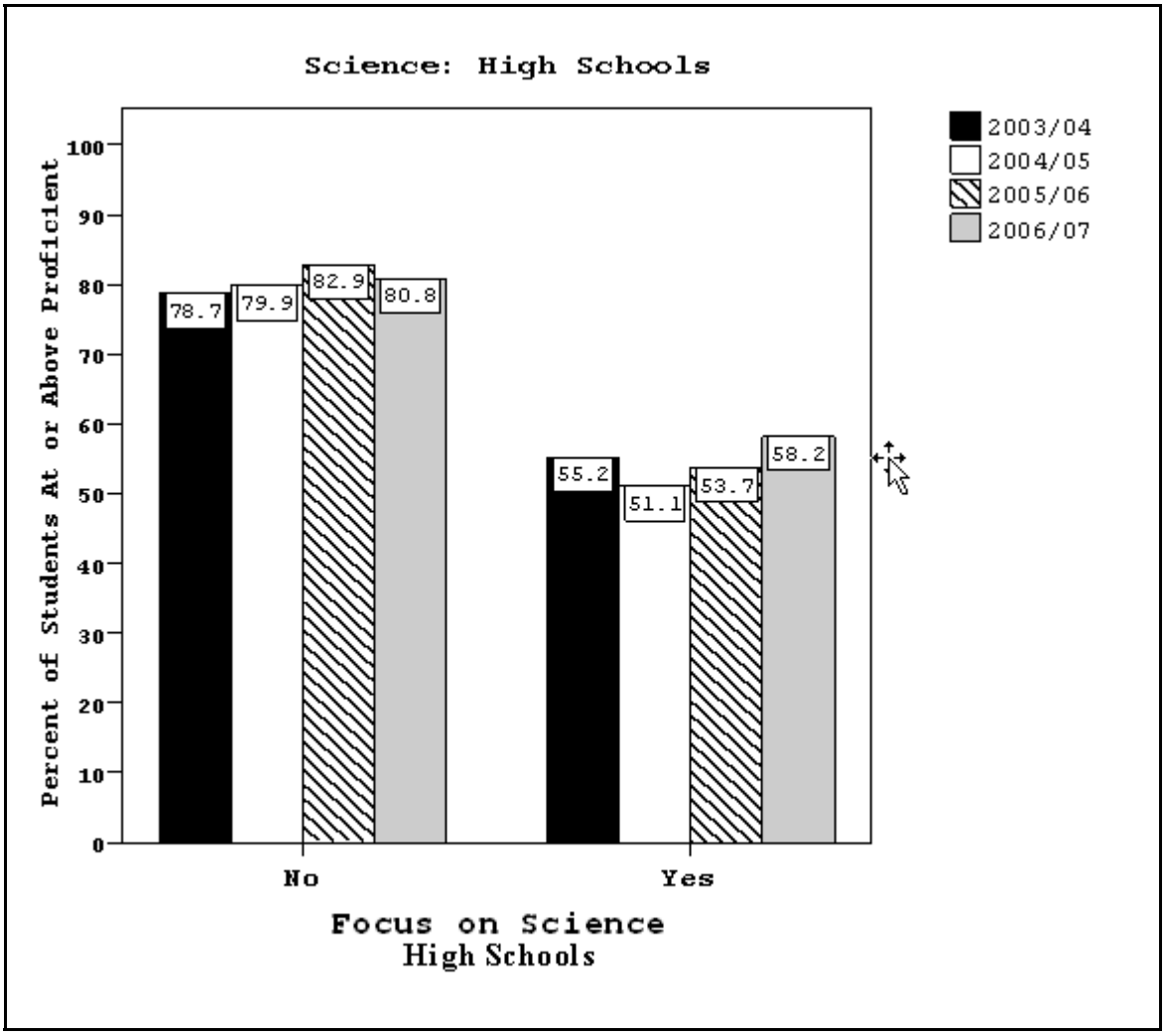


Figure 9. Percent of students at or above proficient on state assessments in mathematics for the middle schools with MSP-MIS student achievement data at each of the four years (2003/04-2006/07).



By gender, the results in Table 7 indicate similar changes in science proficiency for males and females over the entire four-year time period (2003/04-2006/07). Specifically, there is a sustained increase for schools *with* MSP focus on science, with an effect size for males (females) of +.19 (+.21) at the elementary school level, +.11 (+.17) at the middle school level, and +.06 (+.08) at the high school level. For schools *without* MSP focus on science, there is an increase in science proficiency at the elementary school level, with an effect size of +.20 for males and +.13 for females, but there is no change in science proficiency at the middle and high school levels.

Table 7

Longitudinal School Changes in Science Proficiency by Gender for Schools Reporting Data at Each of the Four Years (2003/04-2006/07)

Gender	School Level	MSP Focus on Math	Percent at or above proficient				*Effect Size*	
			Year 1 2003/04	Year 2 2004/05	Year 3 2005/06	Year 4 2006/07	Year 3-Year 4 2005/06-06/07	Year 1–Year 4 2003/04-06/07
Males	Elem.	**Yes**	24.59	31.61	33.03	33.11	No change	+.19
		No	56.19	59.33	64.35	66.12	No change	+.20
	Middle	**Yes**	43.92	44.40	48.11	49.54	No change	+.11
		No	69.77	74.86	67.37	67.80	No change	No change
	High	**Yes**	57.03	52.77	56.88	60.07	+.06	+.06
		No	78.99	79.03	82.95	81.15	No change	No change
Females	Elem.	**Yes**	26.17	31.95	35.37	35.95	No change	+.21
		No	54.77	56.48	59.51	61.20	No change	+.13
	Middle	**Yes**	43.47	43.94	48.17	51.77	+.07	+.17
		No	67.28	74.42	66.57	66.77	No change	No change
	High	**Yes**	53.36	50.03	51.44	57.47	+.12	+.08
		No	77.91	80.72	82.82	80.44	No change	No change

By ethnicity, the results in Table 8 show that there is a sustained increase in science proficiency over the four-year time period (2003/04-2006/07) for the African-American students at all school levels regardless of whether the schools are *with* or *without* MSP focus on science, with the effect size ranging from +.22 to +.49 across school levels, with the exception of "no change" for schools *without* MSP focus on science at the high school level. A similar pattern, with lower effect size (from +.05 to +.30), is observed for White students, except for a decrease for middle schools *without* MSP focus on science. For Hispanic students, there is an increase in science proficiency at the elementary school level (with an effect size of +.12 and +.24 for schools *with* and *without* MSP focus on science, respectively), a slight increase for high schools *with* MSP focus on science (*ES* = +.04), no change for middle and high schools *without* MSP focus on science, and a decrease for middle schools *with* MSP focus on science (*ES* = –.35). For Asian students, no change in science proficiency is observed across all school levels. The same holds for "other race" students, except for an increase at the middle school level (*ES* = .+22) and a decrease at the high school level (*ES* = –.31) for schools *with* MSP focus on science.

For special education students, the results in Table 9 (upper panel) show that there is no consistent pattern in science proficiency across the four years (2003/04-2006/07). Specifically, there is (a) no change for the elementary and middle schools *with* MSP focus on science and for the high schools *without* MSP focus on science, (b) an increase for the elementary schools

without MSP focus on science (*ES* = .+48) and the high schools *with* MSP focus on science (*ES* = +.10), and (c) a decrease for the middle schools *without* MSP focus on science (ES = –.27).

For students with limited English proficiency, the results in Table 9 (lower panel) show that there is (a) no change in science proficiency for all high schools and for the middle schools *without* MSP focus on science, (b) a substantial increase for the middle schools *with* MSP focus on science (*ES* = +.60), and (c) a decrease for the elementary schools *without* MSP focus on science (*ES* = –.27).

Table 8

Longitudinal School Changes in Science Proficiency by Ethnicity for Schools Reporting Data at Each of the Four Years (2003/04-2006/07)

Ethnicity	School Level	MSP Focus on Science	Percent at or above proficient				*Effect Size* of Change	
			Year 1 2003/04	Year 2 2004/05	Year 3 2005/06	Year 4 2005/06	Year 3-Year 4 2005/06-06/07	Year 1-Year 4 2003/04-06/07
White	Elem.	**Yes**	35.9	45.6	47.4	47.1	No change	+.23
		No	81.9	85.8	86.5	91.7	+.17	+.30
	Middle	**Yes**	51.0	49.9	55.0	57.7	+.05	+.13
		No	93.6	93.6	90.0	89.1	No change	–.16
	High	**Yes**	69.8	69.8	71.3	72.2	No change	+.05
		No	88.6	94.2	93.8	92.4	No change	+.13
African-American	Elem.	**Yes**	8.2	12.9	21.9	19.4	No change	+.33
		No	42.0	47.4	51.0	66.3	+.31	+.49
	Middle	**Yes**	29.1	36.1	36.2	40.5	No change	+.24
		No	19.3	34.2	22.5	28.6	+.14	+.22
	High	**Yes**	41.9	33.5	43.2	52.7	+.19	+.22
		No	57.5	55.6	61.3	58.0	No change	No change
Hispanic	Elem.	**Yes**	13.3	15.9	17.4	17.7	No change	+.12
		No	19.0	21.3	30.0	29.3	No change	+.24
	Middle	**Yes**	35.6	33.7	38.3	20.0	–.41	–.35
		No	43.1	46.1	37.0	49.0	No change	No change
	High	**Yes**	48.7	43.4	45.3	50.5	+.10	+.04
		No	65.9	92.9	72.5	77.3	No change	No change
Asian	Elem.	**Yes**	35.8	47.5	56.5	33.3	No change	No change
		No	76.3	80.7	84.4	87.2	No change	No change
	Middle	**Yes**	47.7	54.5	54.4	53.1	No change	No change
		No	69.1	81.2	76.4	64.7	No change	No change
	High	**Yes**	78.6	78.7	84.0	48.0	***	***
		No	91.2	88.9	85.3	92.9	No change	No change
Other	Elem.	**Yes**	22.2	0.1	9.1	47.2	***	***
		No	53.8	46.2	61.1	62.5	No change	No change
	Middle	**Yes**	34.9	40.0	.0	45.9	No change	+.22
		No	89.1	60.0	60.0	80.0	No change	No change
	High	**Yes**	44.7	21.7	35.3	29.7	No change	–.31
		No	90.9	60.0	100.0	75.0	***	***

Note. The notation "***" indicates that there is no sufficient data for reliable estimate of change.

Table 9

Longitudinal School Changes in Science Proficiency for Special Education (SED) and Limited English Proficiency (LEP) Students for Schools Reporting Data at Each of the Four Years (2003/04-2006/07)

SED LEP	School Level	MSP Focus on Science	Percent at or above proficient				*Effect Size*	
			Year 1 2003/04	**Year 2** 2004/05	**Year 3** 2005/06	**Year 4** 2006/07	**Year 3-Year 4** 2005/06-06/07	**Year 1–Year 4** 2003/04-06/07
Special Education Students (SED)	Elem.	**Yes**	10.9	13.7	18.7	14.8	No change	No change
		No	30.6	37.9	44.1	54.1	No change	+.48
	Middle	**Yes**	13.3	8.3	11.6	13.6	No change	No change
		No	38.6	41.6	33.9	25.9	No change	–.27
	High	**Yes**	27.2	22.3	26.3	31.8	+.12	+.10
		No	32.6	21.3	44.4	41.0	No change	No change
Limited English Proficiency (LEP)	Elem.	**Yes**	42.5	51.3	48.9	54.3	+.11	.24
		No	24.0	27.7	16.8	13.5	–.09	–.27
	Middle	**Yes**	5.0	6.4	19.3	24.9	No change	+.60
		No	32.2	23.1	60.0	22.8	–.78	No change
	High	**Yes**	19.1	15.4	14.8	20.0	+.14	No change
		No	50.0	100.0	50.0	57.1	No change	No change

Schools by Direction of Change in Math and Science Proficiency

This results in this section relate to the second research question, RQ2: "What is the distribution of MSP-related schools across categories of change (increase, no change, or decrease) in math and science proficiency over the four-year period of time (2003/04- 2006/07) 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 in math and science proficiency over the time period from the first year (2003/04) to the end year (2006/07) — see Figures 10, 11, and 12, for math, and Figures 13, 14, and 15, for science.

For **math proficiency**, the percentage of schools with an increase is much higher than the percentage of schools with a decrease at all school levels. For schools that fall into the "increase" category, the percentage of schools *with* MSP focus on math is much higher than the percentage of schools *without* MSP focus on math for the elementary schools (53.3% versus 13.6%) and the middle schools (54.2% versus 20.9%). At the high school level, the increase in science proficiency is at a higher rate for schools without MSP focus on math (54.3%) compared to schools *with* MSP focus on math (37.5%).

Figure 10. Percentage of elementary schools *with* (or *without*) MSP focus on math by direction of change (decrease, no change, increase) in math proficiency.

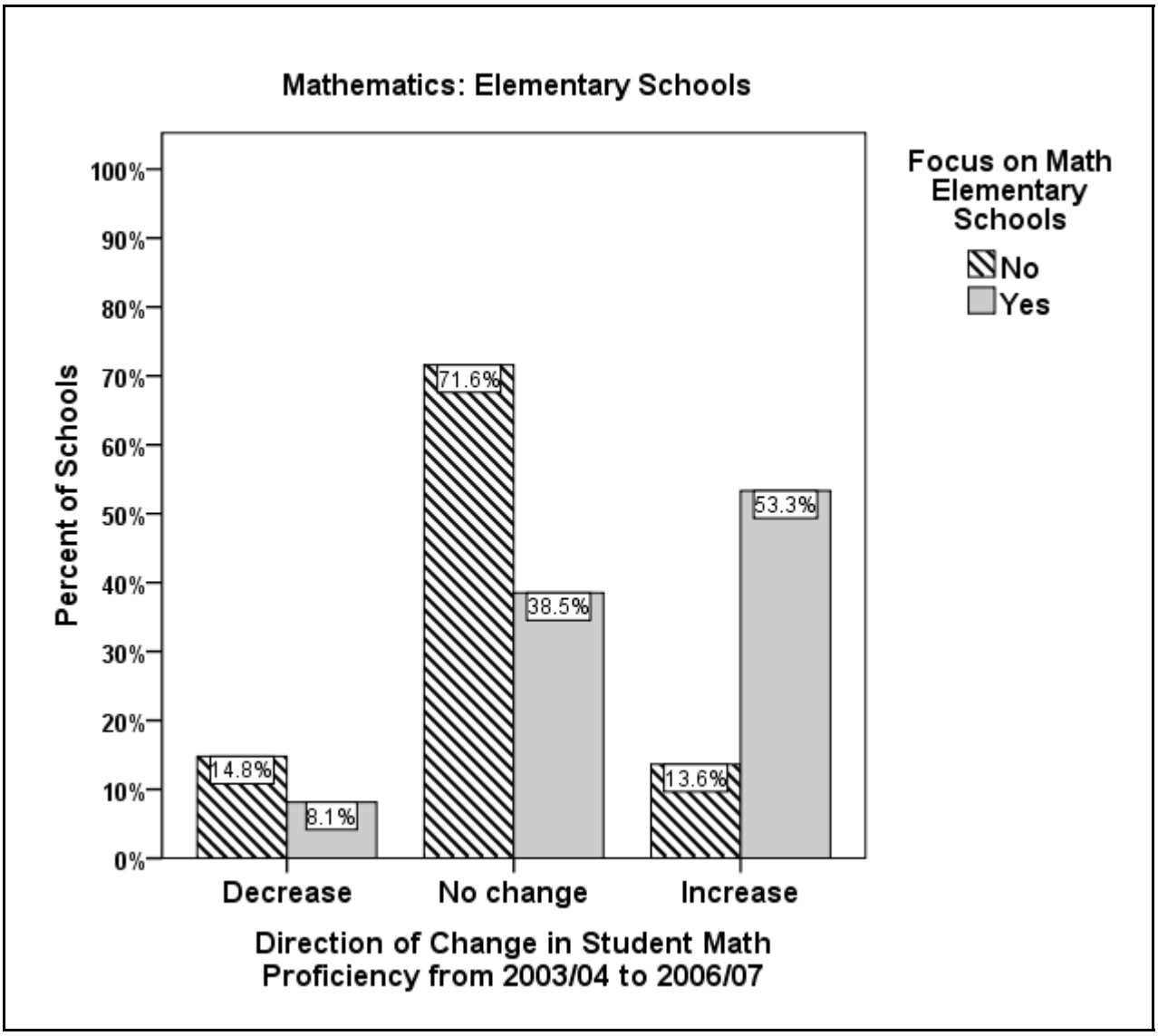


Figure 11. Percentage of middle schools *with* (or *without*) MSP focus on math by direction of change (decrease, no change, increase) in math proficiency.

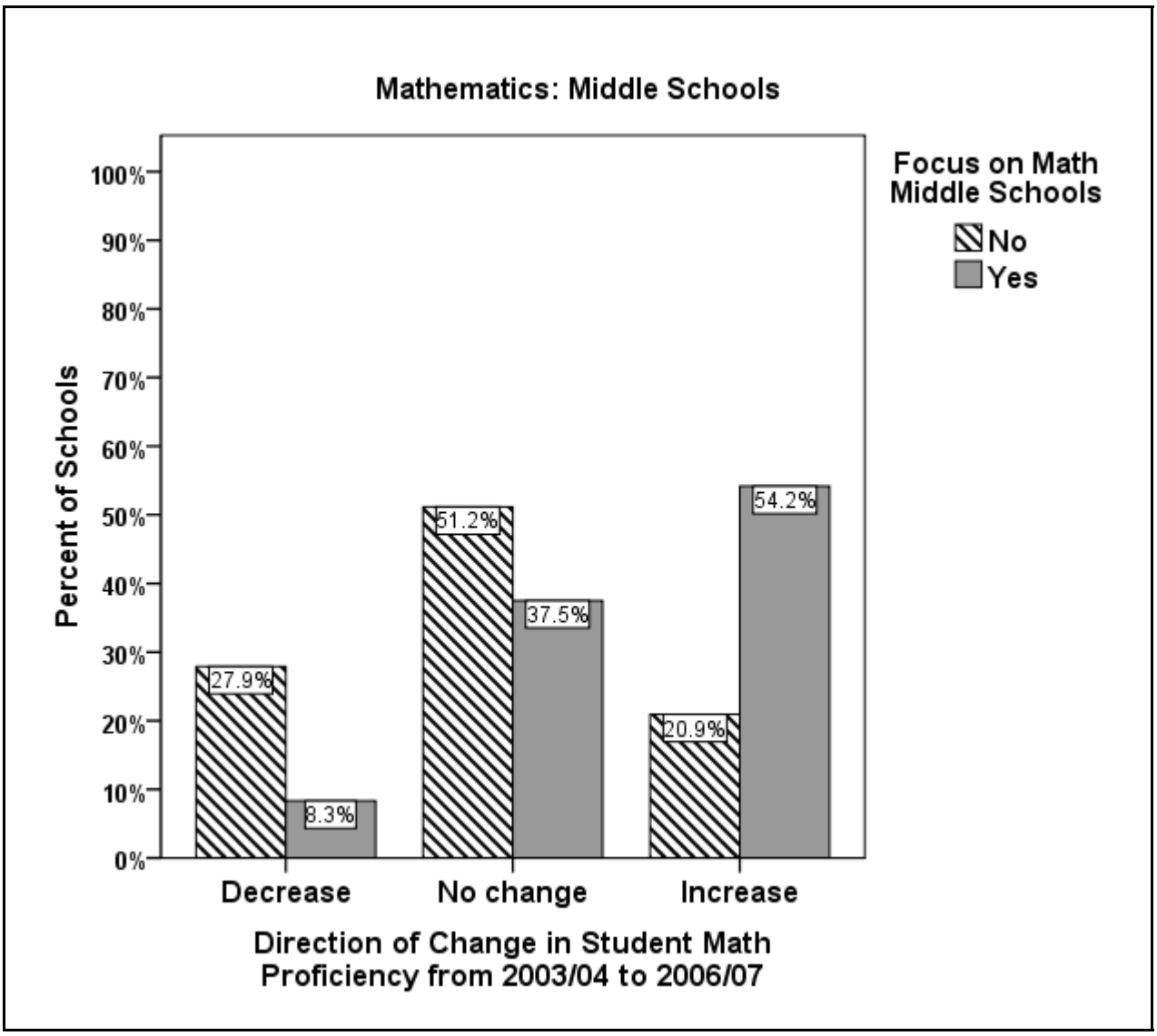
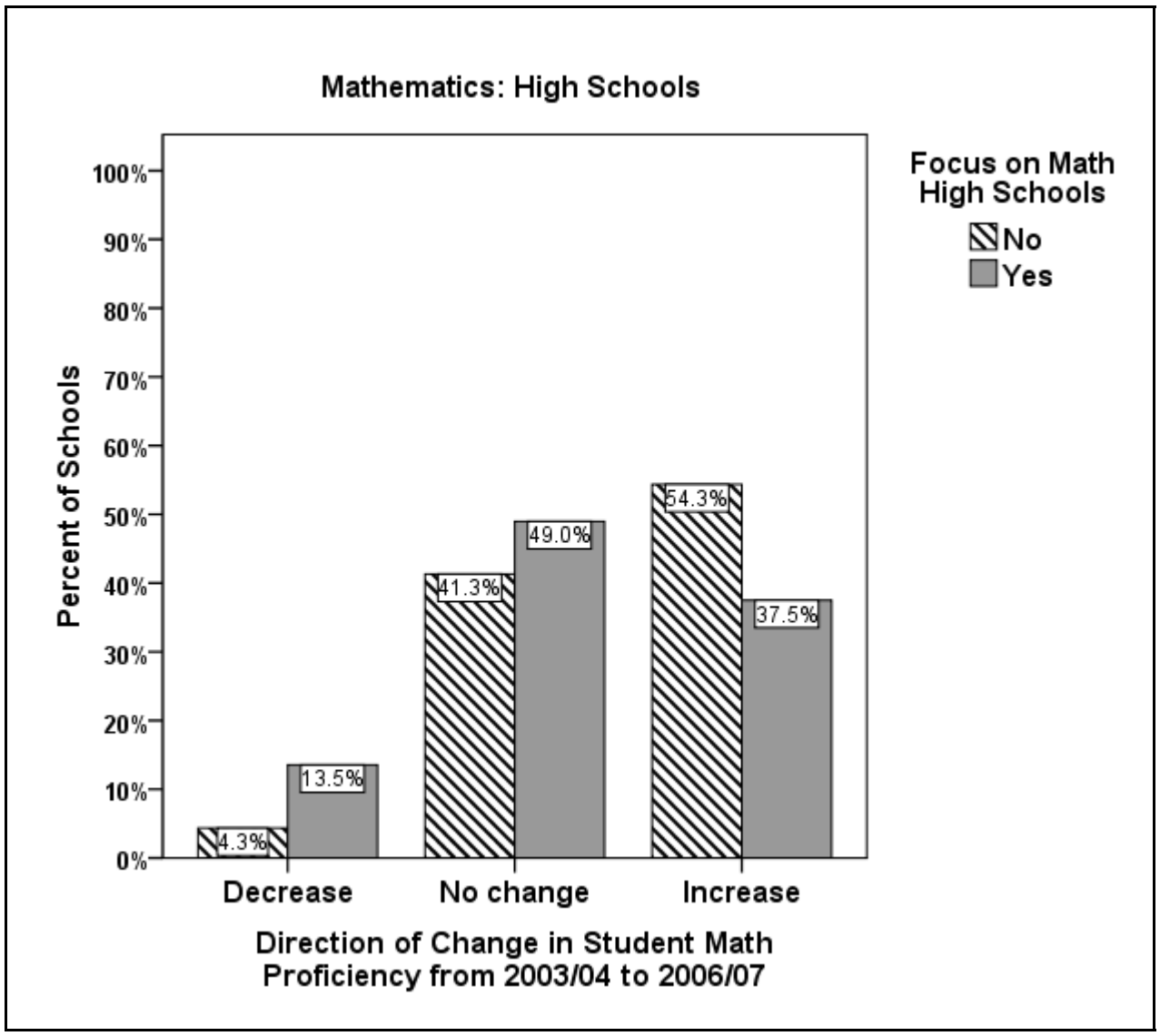


Figure 12. Percentage of high schools *with* (or *without*) MSP focus on math by direction of change (decrease, no change, increase) in math proficiency.



For **science proficiency**, the percentage of schools with a four-year increase is much higher than the percentage of schools with a four-year decrease at all school levels. Also, for the schools that fall into the "increase" category, the percentage of schools *with* MSP focus on science is much higher than the percentage of schools *without* MSP focus on science for the middle schools (44.4% versus 0.0%) and the high schools (32.9% versus 20.0%), but at the elementary school level the schools *without* MSP focus on science increase in science proficiency at a slightly higher rate (44.4%) compared to schools *with* MSP focus on science (41.7%).

Figure 13. Percentage of elementary schools *with* (or *without*) MSP focus on science by direction of change (decrease, no change, increase) in science proficiency.

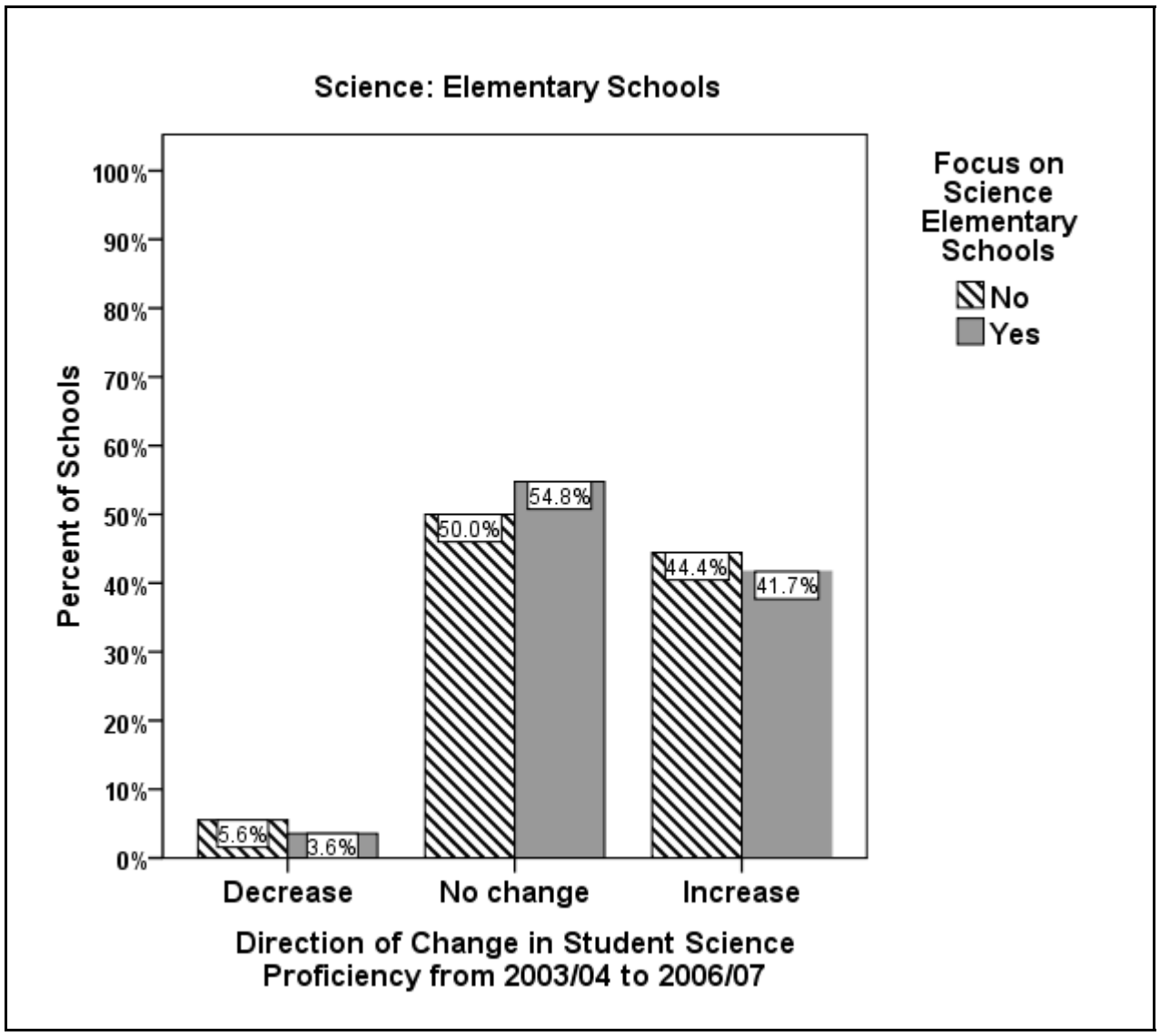


Figure 14. Percentage of middle schools *with* (or *without*) MSP focus on science by direction of change (decrease, no change, increase) in science proficiency.

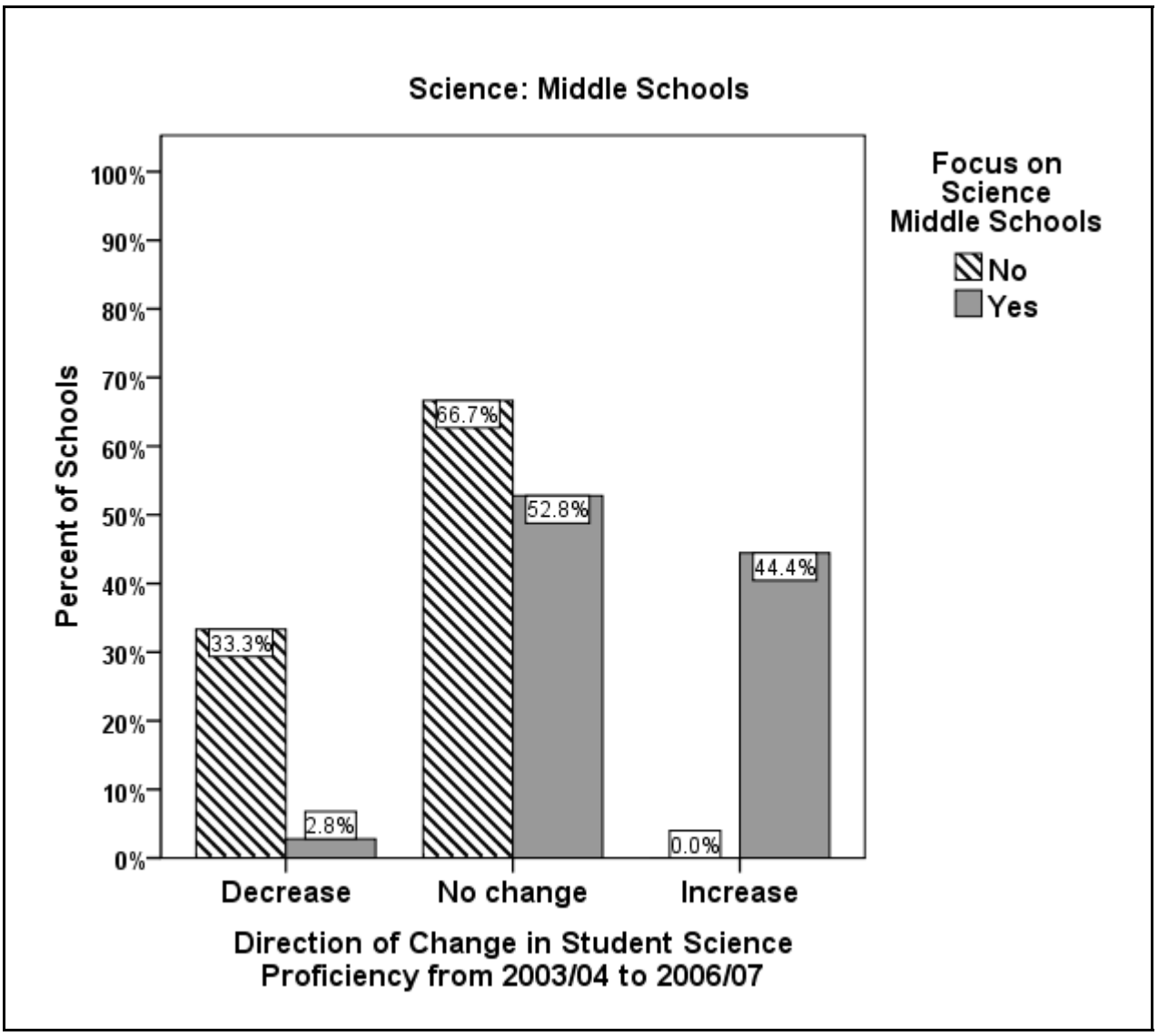
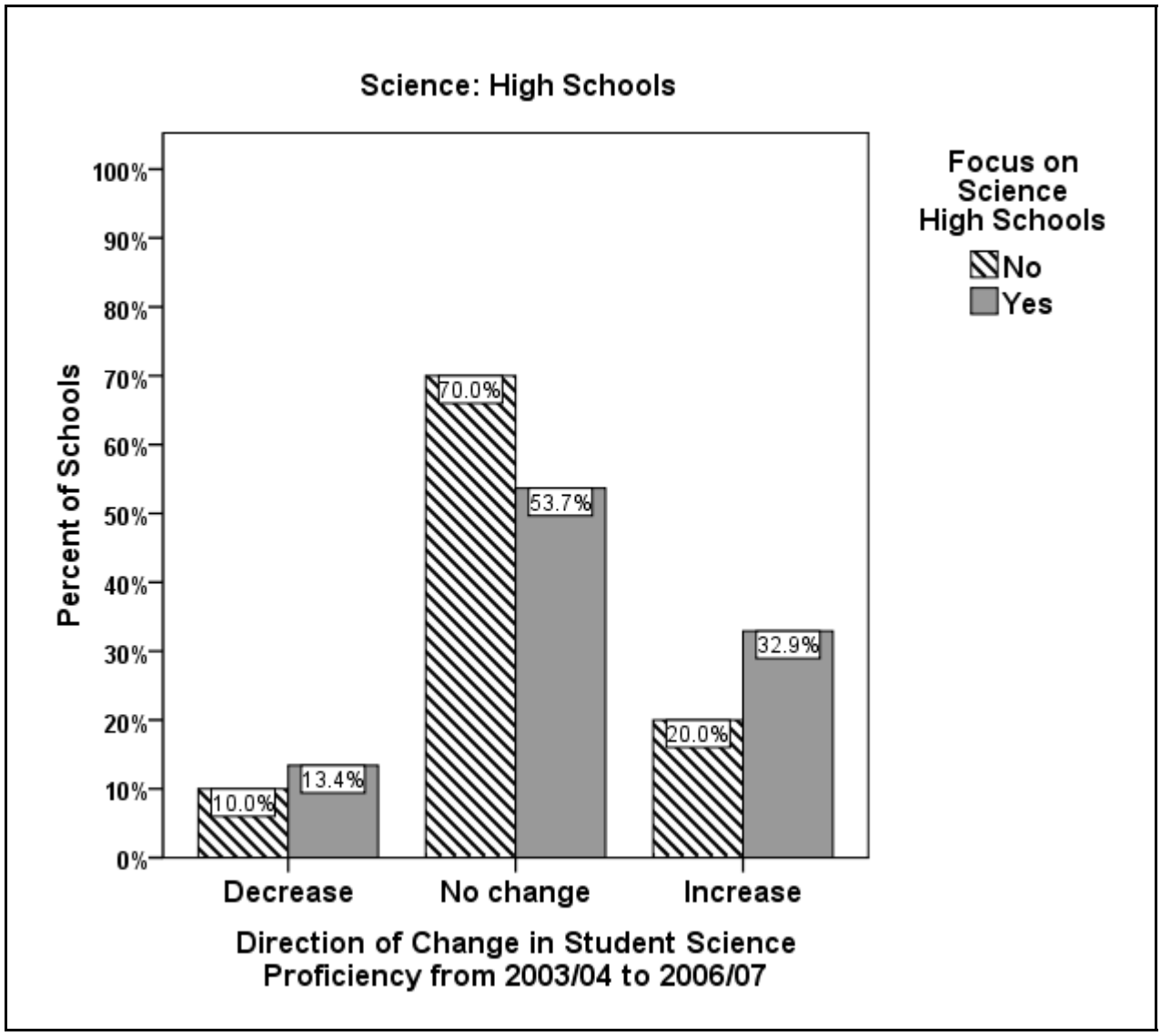


Figure 15. Percentage of high schools *with* (or *without*) MSP focus on science by direction of change (decrease, no change, increase) in science proficiency.



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 four-year period (2003/04 – 2006/07) 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 10, with illustrations of growth trajectories for math and science provided in Appendix C.

As described in the Method section, the units of measurement with the LGM model are individual schools, the school score is the weighted logit score — the natural logarithm of the odds for proficiency in math (or science)—, and the school variable "MSP focus on math (or science)" is a background variable (0 = No, 1 = Yes).

Table 10

Growth Trajectories of Schools in Math and Science Proficiency Across Four Years (2003/04-2006/07) – Relationships Between Initial Status of School Proficiency, Rate of Change, and MSP Focus on Math (or Science)

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	0.972	0.959	0.046	–0.271**	0.486**	–0.381**
MATH MIDDLE	0.919	0.884	0.077	–0.363**	0.367**	–0.008
MATH HIGH	0.966	0.951	0.049	0.002	–0.078	–0.237
SCIENCE ELEMENTARY	0.959	0.941	0.048	–0.446**	0.442*	0.232
SCIENCE MIDDLE	0.952	0.932	0.051	–0.397	0.203	–0.028
SCIENCE HIGH	0.971	0.959	0.038	–0.080	–0.331	0.423*

*$p < .05$. ** $p < .01$.

The results for tests of model fit in Table 10 (left panel) 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 (with criteria for a reasonable fit in parentheses): *Comparative Fit Index* (CFI > .95), *Tucker-Lewis Index* (TLI > .95), and *Standardized Root Mean Square Residual* (SRMR < .08). As can be seen, all estimates of the CFI and TFI are higher than the cutting value for a reasonable data fit (.95), exception for a couple slightly lower TFI values (.884, .932, and .941).

Given the coding (0 = No, 1 = Yes) for the school variable "MSP focus on math (or science)," the statistically significant negative coefficients in the column "Initial Status on MSP Focus" in Table 10 indicate that (a) the schools *without* MSP focus on math have higher initial

status—higher adjusted math proficiency scores in 2003/04—than those *with* MSP focus on math at the elementary and middle school levels (–0.271 and –0.363), and (b) the schools *without* MSP focus on science have higher initial status—higher adjusted science proficiency scores in 2003/04—than those *with* MSP focus on science at the elementary school level (–0.446).

The statistically significant positive coefficients in the column "Rate of Change on MSP Focus" in Table 10 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 elementary school level (0.486) and the middle school level (0.367), 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 elementary level (0.442).

Still in Table 10, the statistically significant negative correlation coefficient (-.381) in the column "Initial Status correlated with Rate of Change" indicates that the elementary schools with lower initial proficiency in math increase at a higher rate. On the other hand, the statistically significant positive correlation coefficient (.423) 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 four-year time period and the schools' success in math and science proficiency at the end year of this time period (2006/07)?" Specifically, provided are results about the relationship between the targeted teacher participation in MSP-related activities over the span of four years (2003/04-2006/07) and the student proficiency in math and science at the end year (2006/07). The Pearson product-moment correlation coefficients for this relationship at the elementary, middle, and high school levels are provided in Table 11. The results indicate that the relationship between the targeted teacher participation in MSP-related activities and student proficiency is statistically significant and positive (yet, relatively small) (a) at the elementary and high school levels for math (.171 and .215, respectively), and (b) at the high school level for science (r = .268).

Table 11

Correlations Between Teacher Participation in MSP Activities Across Four Years (2003/04, 2004/05, 2005/06, 2006/07) and Student Proficiency at the End Year (2006/07)

Subject/ School level	*r*	*N*	*n*
Mathematics			
Elementary	.171**	248	58662
Middle	.093	153	73058
High	.215**	156	73364
Science			
Elementary	.031	108	8536
Middle	.111	45	8507
High	.268**	96	37207

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.
*$p < .05$. ** $p < .01$.

Relationship Between Student Proficiency in Math (or Science) and the "Student/Teacher Ratio" for Students Assessed in Math (or Science) and Math (or Science) Teachers Who Actively Participated in MSP-related Activities.

The results in this section relate to the fifth research question, RQ5: 'What is the relationship between the schools' success in math (or science) proficiency at any year of the time period 2003/04-2006/07 and the "student/teacher ratio" for students who took the state examination in math or science and teachers who actively participated in MSP-related activities during that year?" The correlation matrix for the relationship between student proficiency in math (or science) and the targeted "student/teacher ratio" is provided in Table 12. The counts for students and teachers used for the computation of the correlations in Table 12 are provided in Tables 13 and 14 for mathematics and science, respectively.

The statistically significant negative correlations in Table 11 indicate a positive trend — the smaller the number of students per actively participating teachers, the higher the rate of the school proficiency in math (or science). Thus, the proportional participation of teachers in MSP-related activities is positively related to student proficiency in (a) mathematics at the middle and high school levels, for years 2004/05 and 2005/06, and (b) science at the middle school level for year 2005/06 and the high school level for years 2004/05 and 2005/06. The lack of statistical significance for the targeted relationship at the elementary school level is due, among possible other factors, to the small number of schools for which MIS data were available for the correlational analysis. However, the lack of significance for this relationship at the end year (2006/07) for the middle and high schools needs additional examination in the framework of MSP-PE.

Table 12

Correlation Between Percent of Students At or Above Proficient in Math (or Science) and the Ratio of Number of Students Assessed in Math (or Science) To Number of Teachers who Actively Participated in MSP-related Activities in the School At Each of the Four Years (2003/04-2006/07)

Subject / School Level	Year 2003/04	2004/05	2005/06	2006/07
Mathematics				
Elementary	**.43** (*n* = 11)	**.50** (*n* = 14)	**.11** (*n* = 88)	**.07** (*n* = 19)
Middle	**.06** (*n* = 107)	**–.27**** (*n* = 187)	**–.16**** (*n* = 283)	**–.03** (*n* = 280)
High	**–.06** (*n* = 107)	**–.23**** (*n* = 171)	**–.28**** (*n* = 150)	**–.13** (*n* = 169)
Science				
Elementary	**.02** (*n* = 10)	**–.42** (*n* = 15)	**–.43*** (*n* = 27)	**.13** (*n* = 16)
Middle	**–.26** (*n* = 43)	**.18** (*n* = 104)	**.04** (*n* = 182)	**.03** (*n* = 228)
High	**.01** (*n* = 72)	**–.48**** (*n* = 128)	**–.33**** (*n* = 101)	**–.10** (*n* = 151)

Notes: 1. The Pearson correlation coefficients are in bold (*n* = number of schools);
2. A statistically significant negative correlation indicates a positive trend in the sense that the smaller the number of students per actively participating teacher, the higher the school's rate in math (or science) proficiency.

* $p < .05$. ** $p < .01$.

Table 13

***Mathematics**: School Counts of Students Assessed in Math, Math Teachers, and Math Teachers who Actively Participated in MSP-related Activities Across Four Years (2003/04-2006/07)*

School Level		Year 2003/04	2004/05	2005/06	2006/07
Elementary	a.	(3 — 800) [167]	(79 — 427) [224]	(16 — 795) [240]	(12 — 747) [238]
	b.	(0 — 7) [2]	(6 — 6) [6]	(0 — 6) [3]	(3 — 6) [4]
	c.	(0 — 7) [1]	(6 — 6) [6]	(0 — 6) [1]	(0 — 6) [2]
		(11 *schools*)	(14 *schools*)	(88 *schools*)	(19 schools)
Middle	a.	(32 — 2502) [393]	(50 — 372) [167]	(44 — 1441) [465]	(50 — 1356) [472]
	b.	(0 — 54) [8]	(1 — 8) [3]	(0 — 38) [7]	(0 — 22) [6]
	c.	(0 — 45) [5]	(0 — 5) [2]	(0 — 14) [2]	(3 — 10) [2]
		(107 *schools*)	(187 *schools*)	(283 *schools*)	(280 schools)
High	a.	(8 — 3762) [448]	(77 —2280) [176]	(5 — 2096) [459]	(8 — 2354) [474]
	b.	(1 — 56) [10]	(3 — 8) [61]	(0 — 31) [10]	(1 — 34) [10]
	c.	(0 —43) [7]	(1 — 8) [5]	(0 — 13) [3]	(0 — 14) [3]
		(107 *schools*)	(171 *schools*)	(150 *schools*)	(169 schools)

*Note*s:

1. Reported are only schools with MIS data used for the correlations in Table 11.
2. Given in parentheses is the (min – max) range, with the *mean* given in brackets.

a. number of students assessed in math per school

b. Number of math teachers per school

c. Number of math teachers who actively participated in MSP-related activities of the school.

Table 14

***Science**: School Counts of Students Assessed in Science, Science Teachers, and Science Teachers who Actively Participated in MSP-related Activities Across Four Years (2003/04-2006/07)*

	Year			
School Level	2003/04	2004/05	2005/06	2006/07
Elementary	a. (4 —184) [81]	(12 — 379) [86]	(20 — 585) [113]	(9 — 703) [136]
	b. (0 — 5) [1]	(0 — 3) [1]	(0 — 4) [2]	(1 — 9) [2]
	c. (0 — 4) [1]	(0 — 2) [1]	(0 — 2) [1]	(0 — 9) [1]
	(10 *schools*)	(15 *schools*)	(27 *schools*)	(16 schools)
Middle	a. (41— 834) [219]	(6 — 1331) [296]	(11 — 1299) [333]	(13 — 1157) [292]
	b. (0 — 54) [10]	(1 — 15) [6]	(1 — 25) [7]	(0 — 19) [6]
	c. (0 — 41) [7]	(0 — 10) [3]	(0 — 10) [3]	(0 — 19) [4]
	(43 *schools*)	(104 *schools*)	(182 *schools*)	(228 schools)
High	a. (13— 1385) [371]	(1 —2498) [362]	(3 — 2783) [364]	(2 — 2756) [474]
	b. (1 — 30) [11]	(0 — 41) [9]	(1 — 26) [10]	(0 — 29) [8]
	c. (0 —30) [8]	(0 — 22) [6]	(0 — 22) [4]	(0 — 29) [4]
	(82 *schools*)	(128 *schools*)	(101 *schools*)	(151 schools)

*Note*s: 1. Reported are only schools with MIS data used for the correlations in Table 11.

2. Given in parentheses is the (min – max) range, with the *mean* given in brackets.

a. number of students assessed in science per school

b. Number of science teachers per school

c. Number of science teachers who actively participated in MSP-related activities of the school.

Relationship Between Student Proficiency in Math (or Science) and the Proportion of Students Assessed in Math (or Science) Who Successfully Completed a Regular or Advanced Course in Math (or Science) at the High School Level

The results of this section relate to the sixth and final research question, RQ6: "What is the relationship between the schools' success in math (or science) at any year of the time period 2003/04-2006/07 and the ratio indicating what proportion of the students who took the state examination in math (or science) have successfully completed a regular or advanced course in math (or science) that year?" MSP-MIS data for examination of the targeted relationship is available only at the high school level for math and science. For mathematics, the correlations in Table 15 indicate that the targeted relationship is not statistically significant (at the .05 level of significance) at the high school level regardless of the level (regular or advanced) for which a proportion of successful course completion was computed. The Pearson correlation coefficient varies from .009 to .119, based on a sample size of schools that varied from 52 to 251 high schools.

For science, also at the high school level, the Pearson correlation coefficients for the targeted relationship are also provided in Table 15. While the first year (2003/04) this relationship is not statistically significant ($p > .05$), it is statistically significant (a) the second and third years (2004/05 and 2005/06), for successful completion of either a regular or an advanced course in science, and (b) the end year (2006/07) for successful completion of an advanced course in science. Clearly, the successful completion of a high school course in science is positively related to the student achievement at the state examination, with this relationship being more sizable and sustained for students who completed an advanced course in science at the high school level.

Table 15

Correlations Between Student Success on a State Exam and Successful Completion of a Regular or Advanced Course in Math (or Science) at the High School Level

Year	MATHEMATICS		SCIENCE	
	Regular course	Advanced course	Regular Course	Advanced Course
2003/04	.083 (*n* = 111)	.101 (*n* = 52)	.037 (*n* = 81)	.146 (*n* = 53)
2004/05	.009 (*n* = 191)	.119 (*n* =114)	.218** (*n* = 145)	.368** (*n* = 87)
2005/06	.047 (*n* = 251)	.102 (*n* = 140)	.159* (*n* = 160)	.336** (*n* = 108)
2006/07	.052 (*n* =238)	.062 (*n* = 133)	.057 (*n* = 207)	.438** (*n* = 121)

Note. *n* = number of schools.

*$p < .05$. ** $p < .01$.

Discussion

This study examines longitudinal trends in MSP-related changes in student math and science proficiency using MSP-MIS data with the *Annual K-12 District Survey* for four years, 2003/04, 2004/05, 2005/06, and 2006/07. The results are summarized by the topics of the six research questions addressed in this study.

Trends of Changes in Math and Science Proficiency

Mathematics. Overall, there is an increase in math proficiency from the first year (2003/04) to the end year (2006/07) at all school levels. For the intermediate years within this time period, the increase is well sustained at the elementary and middle school levels, but not at the high school level. With the factor "MSP focus on math" taken into account, there is a decrease in math proficiency after the first two years for schools *without* MSP focus on math, but there is a sustained increase in math proficiency for schools *with* MSP focus on math. At the high school level, there is an increase in math proficiency after the first two years for schools *without* MSP focus on math, whereas the math proficiency for schools *with* MSP focus on math is about the same across the first three years and then increases at the end year (2006/07). The largest "first year-end year" increase in student math proficiency is for schools *with* MSP focus on math at the elementary and middle school levels. Overall, the trend in mathematics proficiency for schools across the four-year time period (2003/04-2006/07) remains the same for both males and females.

By ethnicity, the largest (2003/04-2006/07) increase in math proficiency is for African-American students in schools *with* MSP focus on math at the elementary and middle school levels **versus** the largest decrease in math proficiency in schools *without* MSP focus in math, also for African-American students at the elementary and middle school level. Thus, the "MSP focus on math" factor has the largest effect for the African-American students. To a lesser degree, this holds for the math proficiency of White and Hispanic students— with an increase for schools *with* MSP focus on math at all school levels and a decrease for schools *without* MSP focus at the elementary and middle school levels. For Asian students, there are no changes in math proficiency for the "first year-end year" (2003/04-2006/07) time period, most likely due to a "start high–finish high" effect. For "other race" students, there are no changes in math proficiency for this time period at the elementary and high school levels, but there is a change at

the middle school level, with an increase for schools *with* MSP focus on math versus a decrease for schools *without* MSP focus in math.

For special education students, there is an increase in math proficiency (2003/04-2006/07) for schools *with* MSP focus on math versus a decrease for schools *without* MSP focus in math at the elementary and middle school levels. At the high school level, there is no change in math proficiency for special education students in schools *with* MSP focus on math, but there is an increase for schools *without* MSP focus in math.

For students with limited English proficiency, there is an increase in math proficiency (2003/04-2006/07) for schools *with* MSP focus on math at all school levels, as well as for high schools *without* MSP focus in math, but there is a decrease for schools *without* MSP focus in math at the elementary and middle school levels.

Science. Regarding the overall change in percent of students at or above proficient in science over the entire four-year period (2003/04-2006/07), there is a substantial increase at the elementary and middle school levels, but there is also an initial drop followed by a slight increase from the second year (2004/05) to the end year (2006/07) at the high school level. The increase in science proficiency is sustained for the schools *with* MSP focus on science at all school levels, whereas for the schools *without* MSP focus on science, there is an increase from the first year (2003/04) to the end year (2006/07) at the elementary school level, but there is no change at the middle and high school levels. In effect size measures, the largest increase in science proficiency across the four-year time period (2003/04-2006/07) is at the elementary school level for schools *with* MSP focus on science. This trend in science proficiency remains the same for both males and females.

By ethnicity, there is a sustained increase in science proficiency over the four-year time period (2003/04-2006/07) for the African-American students at all school levels regardless of whether the schools are *with* or *without* MSP focus on science. A similar pattern, but with a lower effect size, is observed for White students, except for a decrease for schools *without* MSP focus on science. For Hispanic students, there is an increase in science proficiency at the elementary school level, a slight increase for high schools *with* MSP focus on science, no change for middle and high schools *without* MSP focus on science, and a decrease for middle schools with MSP focus on science. Regardless of school level, there is no change in science proficiency for the Asian students. The same holds for "other race" students, except for an increase at the middle school level and a decrease at the high school level for schools *with* MSP focus on science.

Schools by Direction of Change in Math and Science Proficiency

For **math proficiency**, the percentage of schools with an increase is much higher than the percentage of schools with a decrease at all school levels. For schools that fall into the "increase" category, the percentage of schools *with* MSP focus on math is much higher than the percentage of schools *without* MSP focus on math for the elementary and the middle schools. For the high schools, the increase in science proficiency is at a higher rate for schools *without* MSP focus on math versus schools *with* MSP focus on math.

For **science proficiency**, the percentage of schools with a four-year increase is much higher than that of schools with a four-year decrease at all school levels. Also, for the schools that fall into the "increase" category, the percentage of schools *with* MSP focus on science is much higher than the percentage of schools *without* MSP focus on science at the middle and the high school levels. However, elementary schools *without* MSP focus on science increase in science proficiency at a slightly higher rate compared to schools *with* MSP focus on science.

Longitudinal Growth Trajectories in School Math and Science Proficiency

Mathematics. The analysis of growth trajectories showed that the schools *without* MSP focus on math have higher initial status—higher weighted logit scores in 2003/04—than those *with* MSP focus on math at the elementary and middle school levels. Also, the schools *with* MSP focus on math increase at a higher rate in math proficiency compared to those *without* MSP focus on math at the elementary and middle school levels, and (b) the schools *with* MSP focus on science increase at a higher rate in science proficiency compared to those *without* MSP focus on science at the elementary level. Further, the elementary schools with lower initial proficiency in math increase at a higher rate. These results imply that the MSP focus on schools with initially lower performance in math proficiency has resulted in making such schools improve at higher rates compared to MSP schools with initially higher performance in math proficiency but *without* MSP focus on math.

Science. The analysis of growth trajectories in science proficiency showed that the schools *without* MSP focus on science have higher initial status than those *with* MSP focus on science at the elementary school level. However, the schools *with* MSP focus on science increase at higher rate in science proficiency compared to those *without* MSP focus on science at the elementary level. Also, the schools with higher initial proficiency in science increase at a higher rate at the high school level.

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

The Pearson product-moment correlation coefficients for the relationship between targeted teacher participation in MSP-related activities and student proficiency in math and science show that this relationship is positive (yet, relatively weak) at the elementary and high school levels for math, and also positive (yet, somewhat stronger) at the high school level for science.

Relationship Between Student Proficiency in Math (or Science) and the "Student/Teacher Ratio" for Students Assessed in Math (or Science) and Math (or Science) Teachers Who Actively Participated in MSP-related Activities

The Pearson product-moment correlation coefficients for the targeted relationship indicated that the smaller the number of students per actively participating teachers, the higher the rate of the school proficiency in math (or science). Specifically, relative to the number of students assessed in math (or science) proficiency, the proportional participation of teachers in MSP-related activities is positively related to student proficiency in (a) mathematics at the middle and high school levels, for years 2004/05 and 2005/06, and (b) science at the middle school level for year 2005/06 and the high school level for years 2004/05 and 2005/06. The lack of statistical significance for the targeted relationship at the elementary school level is possibly due, among possible other factors, to the small number of schools for which MIS data were available for the correlational analysis. The lack of significance for this relationship at the end year (2006/07) for the middle and high schools would require additional examination in the framework of MSP-PE.

Relationship Between Student Proficiency in Math (or Science) and the Proportion of Students Assessed in Math (or Science) Who Successfully Completed a Regular or Advanced Course in Math (or Science)

MSP-MIS data for examination of the targeted relationship is available only at the high school level for math and science. For **mathematics**, the results indicated that this relationship was not significant at the high school level regardless of the level (regular or advanced) for which the proportion of successful course completion was computed. For **science**, at the high school level, the results indicated that the successful completion of a science course is positively related to the student achievement at the state examination in science. This relationship is more

sizable and sustained for students who have completed an advanced course in science at the high school level.

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 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 schools' targeted teacher participation in MSP-related activities.

Another 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 hypotheses 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. However, while the preferred design of random assignment to groups is not applicable in this study of MSP-MIS data, we can argue that the employed design of comparing schools *with* and *without* MSP focus on math (or science) is a sound alternative (and probably better that any other two-group design) because it examines the effect of "MSP focus" within the pool of MSP schools.

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.

Further, to maintain statistical correctness and validity of the results in this study, 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 by using weighted logit score—the natural logarithm of the odds for proficiency in math (or science).

Additional analyses that can counteract the limitations with this study are next steps in the MSP-PE agenda. Such analyses 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 MSP-MIS data, the results indicate promising trends and relationships between student proficiency in mathematics and science and MSP-related activities.

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APPENDIX A

Number of Students Assessed (N) on a State Proficiency Test in Math (or Science) and Number of Students At or Above Proficient (P) for Schools with MSP-MIS Data on Student Achievement for Any of the Four Years 2003/04, 2004/05, 2005/06, and 2006/07

	MATHEMATICS			SCIENCE		
	***Elementary* Schools**	***Middle* Schools**	***High* Schools**	***Elementary* Schools**	***Middle* Schools**	***High* Schools**
All students						
2003/04	N = 52926 P = 25119 318 Schools	N = 71380 P = 31599 178 Schools	N = 78849 P = 37188 176 Schools	N = 10838 P = 3511 134 Schools	N = 14458 P = 6389 66 Schools	N = 39647 P = 22628 107 Schools
2004/05	N = 91338 P = 57685 560 Schools	N = 135891 P = 70442 297 Schools	N = 110670 P = 53111 267 Schools	N = 16876 P = 8073 197 Schools	N = 47048 P = 28864 159 Schools	N = 65960 P = 33076 230 Schools
2005/06	N = 158044 P = 105408 733 Schools	N = 262971 P = 140554 297 Schools	N = 142323 P = 65452 338 Schools	N = 32817 P = 20187 301 Schools	N = 79658 P = 43320 242 Schools	N = 79381 P = 41486 230 Schools
2006/07	N = 199853 P = 139222 801 Schools	N = 278329 P = 166259 499 Schools	N = 138864 P = 72121 366 Schools	N = 57647 P = 34642 450 Schools	N = 92347 P = 53637 320 Schools	N = 91354 P = 47086 291 Schools

	MATHEMATICS			SCIENCE		
	***Elementary* Schools**	***Middle* Schools**	***High* Schools**	***Elementary* Schools**	***Middle* Schools**	***High* Schools**
Males						
2003/04	N = 26746 P = 12507 318 Schools	N = 31599 P = 15708 178 Schools	N = 36979 P = 18995 172 Schools	N = 5300 P = 1684 130 Schools	N = 7344 P = 3285 66 Schools	N = 19749 P = 11574 104 Schools
2004/05	N = 41009 P = 25177 463 Schools	N = 51393 P = 25013 230 Schools	N = 50546 P = 23689 220 Schools	N = 7440 P = 3181 186 Schools	N = 12137 P = 6561 109 Schools	N = 29416 P = 14991 144 Schools
2005/06	N = 75687 P = 48790 673 Schools	N = 115441 P = 63179 401 Schools	N = 59120 P = 30376 288 Schools	N = 15863 P = 9733 278 Schools	N = 37676 P = 21320 215 Schools	N = 36469 P = 20442 201 Schools
2006/07	N = 94847 P = 64876 726 Schools	N = 124948 P = 72056 441 Schools	N = 62086 P = 33497 311 Schools	N = 28270 P = 16746 424 Schools	N = 43794 P = 24649 293 Schools	N = 40105 P = 21934 240 Schools
Females						
2003/04	N = 25856 P = 12479 318 Schools	N = 35332 P = 15873 178 Schools	N = 39074 P = 18144 172 Schools	N = 5294 P = 1718 131 Schools	N = 7101 P = 3098 66 Schools	N = 19740 P = 10950 104 Schools
2004/05	N = 39214 P = 24652 463 Schools	N = 50240 P = 24796 230 Schools	N = 50023 P = 23274 220 Schools	N = 7231 P = 3057 186 Schools	N = 11625 P = 6163 109 Schools	N = 29182 P = 14139 143 Schools
2005/06	N = 72753 P = 47681 673 Schools	N = 112590 P = 63790 401 Schools	N = 59620 P = 30357 290 Schools	N = 15437 P = 9666 278 Schools	N = 37094 P = 20606 215 Schools	N = 37197 P = 19385 202 Schools
2006/07	N = 90952 P = 63692 727 Schools	N = 120349 P = 71380 441 Schools	N = 62935 P = 33832 312 Schools	N = 27662 P = 16490 424 Schools	N = 42553 P = 23950 293 Schools	N = 40904 P = 21688 241 Schools

APPENDIX A (Continued)

	MATHEMATICS			SCIENCE		
	***Elementary* Schools**	***Middle* Schools**	***High* Schools**	***Elementary* Schools**	***Middle* Schools**	***High* Schools**
White						
2003/04	N = 12329 P = 9318 182 Schools	N = 22627 P = 15074 118 Schools	N = 17620 P = 11432 121 Schools	N = 4475 P = 1997 99 Schools	N = 6858 P = 4160 52 Schools	N = 11941 P = 8661 79 Schools
2004/05	N = 26969 P = 21435 347 Schools	N = 41589 P = 29479 196 Schools	N = 27289 P = 18638 188 Schools	N = 5965 P = 3598 162 Schools	N = 13092 P = 9121 107 Schools	N = 17902 P = 13619 134 Schools
2005/06	N = 62046 P = 46297 534 Schools	N = 94398 P = 65231 334 Schools	N = 32499 P = 22146 204 Schools	N = 10136 P = 7187 217 Schools	N = 21020 P = 15430 178 Schools	N = 18731 P = 14511 143 Schools
2006/07	N = 77724 P = 61898 587 Schools	N = 110453 P = 79225 380 Schools	N = 39512 P = 28640 258 Schools	N = 19938 P = 15365 270 Schools	N = 32036 P = 22651 225 Schools	N = 23528 P = 17830 187 Schools
African American						
2003/04	N = 6571 P = 2357 176 Schools	N = 10001 P = 2612 107 Schools	N = 6170 P = 2126 105 Schools	N = 1290 P = 229 87 Schools	N = 3634 P = 618 54 Schools	N = 4952 P = 2357 71 Schools
2004/05	N = 13421 P = 6747 278 Schools	N = 15595 P = 5733 161 Schools	N = 10455 P = 3483 152 Schools	N = 2178 P = 722 103 Schools	N = 5287 P = 1626 72 Schools	N = 8036 P = 3074 105 Schools
2005/06	N = 37561 P = 23954 452 Schools	N = 39987 P = 17633 277 Schools	N = 12839 P = 5283 159 Schools	N = 12478 P = 8752 174 Schools	N = 19237 P = 7915 132 Schools	N = 9567 P = 4410 103 Schools
2006/07	N = 53619 P = 34832 540 Schools	N = 48072 P = 23360 329 Schools	N = 18824 P = 9664 220 Schools	N = 24112 P = 10217 186 Schools	N = 24112 P = 10217 186 Schools	N = 14917 P = 6745 165 Schools
Hispanic/Latino						
2003/04	N = 30254 P = 11373 271 Schools	N = 29013 P = 8186 155 Schools	N = 48342 P = 20143 134 Schools	N = 3763 P = 800 117 Schools	N = 1846 P = 726 54 Schools	N = 18513 P = 9023 83 Schools
2004/05	N = 37458 P = 20189 360 Schools	N = 41270 P = 12143 227 Schools	N = 59203 P = 22808 193 Schools	N = 5634 P = 1626 133 Schools	N = 4925 P = 1923 109 Schools	N = 29152 P = 10373 124 Schools
2005/06	N = 40411 P = 20965 475 Schools	N = 72099 P = 29034 342 Schools	N = 58645 P = 22413 227 Schools	N = 6147 P = 1899 187 Schools	N = 19087 P = 8040 187 Schools	N = 29736 P = 10701 147 Schools
2006/07	N = 44159 P = 25077 574 Schools	N = 71355 P = 31283 337 Schools	N = 61042 P = 25081 234 Schools	N = 11389 P = 5831 333 Schools	N = 23379 P = 11815 232 Schools	N = 36448 P = 15600 188 Schools
Asian						
2003/04	N = 394 P = 288 97 Schools	N = 4665 P = 3614 82 Schools	N = 2969 P = 1885 75 Schools	N = 248 P = 119 72 Schools	N = 313 P = 148 38 Schools	N = 1854 P = 1457 56 Schools
2004/05	N = 932 P = 735 183 Schools	N = 5700 P = 4432 130 Schools	N = 2856 P = 1576 119 Schools	N = 242 P = 155 65 Schools	N = 478 P = 286 65 Schools	N = 2530 P = 1732 80 Schools
2005/06	N = 1654 P = 1322 271 Schools	N = 9210 P = 7315 225 Schools	N = 3553 P = 2132 126 Schools	N = 469 P = 345 100 Schools	N = 2696 P = 2114 110 Schools	N = 2619 P = 1898 83 Schools
2006/07	N = 2308 P = 1925 305 Schools	N = 9517 P = 7611 228 Schools	N = 3842 P = 2693 152 Schools	N = 782 P = 601 139 Schools	N = 2818 P = 2153 134 Schools	N = 1995 P = 1146 102 Schools
Others						
2003/04	N = 3378 P = 1783 202 Schools	N = 5074 P = 2113 121 Schools	N = 3748 P = 1602 118 Schools	N = 1062 P = 366 103 Schools	N = 1807 P = 737 58 Schools	N = 2387 P = 1130 85 Schools
2004/05	N = 4787 P = 3754 192 Schools	N = 21944 P = 14247 147 Schools	N = 5049 P = 4034 117 Schools	N = 1892 P = 1644 51 Schools	N = 19043 P = 14463 75 Schools	N = 4401 P = 2724 73 Schools
2005/06	N = 4451 P = 3002 363 Schools	N = 19006 P = 11514 251 Schools	N = 12679 P = 8901 145 Schools	N = 1235 P = 970 104 Schools	N = 12783 P = 8050 121 Schools	N = 9223 P = 5860 106 Schools
2006/07	N = 6273 P = 4194 436 Schools	N = 11011 P = 4894 284 Schools	N = 3009 P = 1327 151 Schools	N = 1156 P = 792 163 Schools	N = 3415 P = 1631 131 Schools	N = 2532 P = 513 95 Schools

APPENDIX A (Continued)

	MATHEMATICS			SCIENCE		
	***Elementary* Schools**	***Middle* Schools**	***High* Schools**	***Elementary* Schools**	***Middle* Schools**	***High* Schools**
Special Education Students						
2003/04	N = 4719 P = 1448 263 Schools	N = 6779 P = 1181 153 Schools	N = 5516 P = 936 133 Schools	N = 980 P = 157 94 Schools	N = 1763 P = 341 57 Schools	N = 2181 P = 599 76 Schools
2004/05	N = 8140 P = 3059 392 Schools	N = 10138 P = 2038 205 Schools	N = 7062 P = 1240 184 Schools	N = 1392 P = 411 130 Schools	N = 3049 P = 736 99 Schools	N = 4236 P = 917 120 Schools
2005/06	N = 15748 P = 6515 599 Schools	N = 17598 P = 3761 322 Schools	N = 6517 P = 1391 189 Schools	N = 3044 P = 1554 211 Schools	N = 6051 P = 1459 174 Schools	N = 4243 P = 986 131 Schools
2006/07	N = 18005 P = 7719 618 Schools	N = 23588 P = 6006 366 Schools	N = 9296 P = 1932 238 Schools	N = 4394 P = 1885 306 Schools	N = 5766 P = 1676 193 Schools	N = 5038 P = 1313 166 Schools

	MATHEMATICS			SCIENCE		
	***Elementary* Schools**	***Middle* Schools**	***High* Schools**	***Elementary* Schools**	***Middle* Schools**	***High* Schools**
Limited English Proficiency Students						
2003/04	N = 21616 P = 7232 212 Schools	N = 19862 P = 4632 127 Schools	N = 17344 P = 3854 115 Schools	N = 1717 P = 133 80 Schools	N = 406 P = 61 34 Schools	N = 3474 P = 669 62 Schools
2004/05	N = 26949 P = 13358 303 Schools	N = 24182 P = 5267 165 Schools	N = 21119 P = 4881 148 Schools	N = 2763 P = 303 100 Schools	N = 1185 P = 106 58 Schools	N = 9006 P = 960 84 Schools
2005/06	N = 29799 P = 14363 423 Schools	N = 31686 P = 7917 269 Schools	N = 21288 P = 4620 152 Schools	N = 3106 P = 544 139 Schools	N = 6063 P = 832 136 Schools	N = 9083 P = 905 87 Schools
2006/07	N = 30310 P = 15793 451 Schools	N = 31232 P = 9133 272 Schools	N = 23704 P = 6248 167 Schools	N = 6943 P = 3719 220 Schools	N = 9731 P = 4545 169 Schools	N = 14121 P = 4718 131 Schools

APPENDIX B

Number of Students Assessed (N) on a State Proficiency Test in Math or Science and Number of Students At or Above Proficient (P) for Schools with MSP-MIS Data on Student Achievement for Each of the Four Years 2003/04, 2004/05, 2005/06, and 2006/07

	MATHEMATICS			SCIENCE		
	***Elementary* Schools**	***Middle* Schools**	***High* Schools**	***Elementary* Schools**	***Middle* Schools**	***High* Schools**
All students						
2003/04	N = 41843 P =21185 223 Schools	N = 62273 P = 28571 139 Schools	N = 71928 P = 34689 143 Schools	N = 8703 P = 2725 102 Schools	N = 8100 P = 3891 42 Schools	N = 37629 P = 21341 92 Schools
2004/05	N = 42615 P = 24860 223 Schools	N = 60169 P = 31309 139 Schools	N = 69623 P = 33872 143 Schools	N = 8553 P = 3162 102 Schools	N = 8326 P = 4011 42 Schools	N = 38964 P = 20610 92 Schools
2005/06	N = 54036 P = 31542 223 Schools	N = 70223 P = 36006 139 Schools	N = 68153 P = 34132 143 Schools	N = 8319 P = 3295 102 Schools	N = 8317 P = 4171 42 Schools	N = 37421 P = 20795 92 Schools
2006/07	N = 53749 P = 32954 223 Schools	N = 70405 P = 38223 139 Schools	N = 69859 P = 36674 143 Schools	N = 8084 P = 3273 102 Schools	N = 7846 P = 4233 42 Schools	N = 35963 P = 21543 92 Schools

	MATHEMATICS			SCIENCE		
	***Elementary* Schools**	***Middle* Schools**	***High* Schools**	***Elementary* Schools**	***Middle* Schools**	***High* Schools**
Males						
2003/04	N = 21004 P = 10505	N = 31503 P = 14235	N = 35977 P = 17535	N = 4386 P = 1354	N = 4096 P = 1982	N = 18712 P = 10928
2004/05	N = 10505 P = 12306	N = 29735 P = 15255	N = 33967 P = 16710	N = 4305 P = 1600	N = 3639 P = 1830	N = 19001 P = 10352
2005/06	N = 27434 P = 15313	N = 34821 P = 16047	N = 33140 P = 16950	N = 4175 P = 1622	N = 3644 P = 1900	N = 18115 P = 10612
2006/07	N = 26336 P = 15801	N = 31319 P = 16572	N = 33797 P = 18092	N = 4032 P = 1595	N = 3399 P = 1807	N = 17434 P = 10744
Females						
2003/04	N = 20510 P = 10540	N = 30756 P = 14328	N = 35580 P = 16910	N = 4311 P = 1371	N = 3997 P = 1907	N = 18761 P = 10309
2004/05	N = 20930 P = 12276	N = 28980 P = 15195	N = 33322 P = 16155	N = 4203 P = 1538	N = 3518 P = 1771	N = 18891 P = 9835
2005/06	N = 26394 P = 15001	N = 33906 P = 16261	N = 32748 P = 16342	N = 4117 P = 1653	N = 3563 P = 1843	N = 18197 P = 9746
2006/07	N = 25248 P = 15694	N = 30373 P = 16509	N = 33540 P = 17633	N = 4034 P = 1661	N = 3368 P = 1842	N = 17313 P = 10266

APPENDIX B (Continued)

	MATHEMATICS			SCIENCE		
	***Elementary* Schools**	***Middle* Schools**	***High* Schools**	***Elementary* Schools**	***Middle* Schools**	***High* Schools**
White						
2003/04	N = 11007 P = 8232	N = 20474 P = 13632	N = 15790 P = 10166	N = 4389 P = 1965	N = 4373 P = 2557	N = 11247 P = 8144
2004/05	N = 11491 P = 8935	N = 22574 P = 16153	N = 15681 P = 10606	N = 4209 P = 2244	N = 4536 P = 2662	N = 10935 P = 7904
2005/06	N = 21660 P = 14673	N = 30149 P = 18482	N = 15613 P = 10878	N = 4086 P = 2230	N = 4372 P = 2716	N = 10969 P = 8169
2006/07	N = 20433 P = 14933	N = 26242 P = 18587	N = 15204 P = 11012	N = 3898 P = 2149	N = 4291 P = 2718	N = 10995 P = 8277
African American						
2003/04	N = 4816 P = 1666	N = 7484 P = 2149	N = 4967 P = 1663	N = 887 P = 143	N = 831 P = 202	N = 4280 P = 1910
2004/05	N = 4955 P = 2155	N = 7831 P = 2679	N = 5009 P = 1520	N = 764 P = 166	N = 878 P = 310	N = 4591 P = 1696
2005/06	N = 4644 P = 1922	N = 8665 P = 1959	N = 5044 P = 1926	N = 669 P = 206	N = 1033 P = 318	N = 4424 P = 2053
2006/07	N = 4245 P = 1990	N = 6954 P = 2607	N = 5221 P = 2157	N = 675 P = 220	N = 887 P = 313	N = 3741 P = 2018
Hispanic/Latino						
2003/04	N = 23232 P = 9866	N = 24907 P = 7285	N = 44768 P = 19496	N = 2752 P = 398	N = 1027 P = 371	N = 18428 P = 8984
2004/05	N = 22560 P = 11673	N = 20544 P = 6429	N = 43274 P = 18966	N = 2765 P = 472	N = 1115 P = 385	N = 19396 P = 8423
2005/06	N = 23814 P = 11850	N = 21971 P = 6741	N = 42017 P = 18639	N = 2694 P = 538	N = 1258 P = 480	N = 18553 P = 8423
2006/07	N = 23037 P = 12510	N = 20512 P = 6803	N = 43419 P = 20496	N = 2444 P = 507	N = 451 P = 118	N = 17536 P = 8879
Asian						
2003/04	N = 395 P = 287	N = 4658 P = 3611	N = 2930 P = 1865	N = 252 P = 121	N = 250 P = 131	N = 1848 P = 1456
2004/05	N = 230 P = 174	N = 4324 P = 3564	N = 2008 P = 1155	N = 97 P = 65	N = 170 P = 111	N = 1805 P = 1422
2005/06	N = 448 P = 337	N = 5019 P = 4015	N = 2137 P = 1317	N = 87 P = 67	N = 169 P = 104	N = 1753 P = 1473
2006/07	N = 413 P = 330	N = 4426 P = 3547	N = 1704 P = 1094	N = 120 P = 82	N = 149 P = 87	N = 271 P = 149
Others						
2003/04	N = 2393 P = 1134	N = 4750 P = 1894	N = 3473 P = 1499	N = 423 P = 98	N = 1619 P = 630	N = 1826 P = 847
2004/05	N = 1099 P = 633	N = 1862 P = 820	N = 766 P = 353	N = 33 P = 6	N = 42 P = 20	N = 180 P = 41
2005/06	N = 674 P = 319	N = 1619 P = 589	N = 394 P = 136	N = 29 P = 12	N = 6 P = 3	N = 191 P = 79
2006/07	N = 1292 P = 598	N = 2375 P = 1016	N = 724 P = 318	N = 254 P = 121	N = 615 P = 284	N = 113 P = 39

APPENDIX B (Continued)

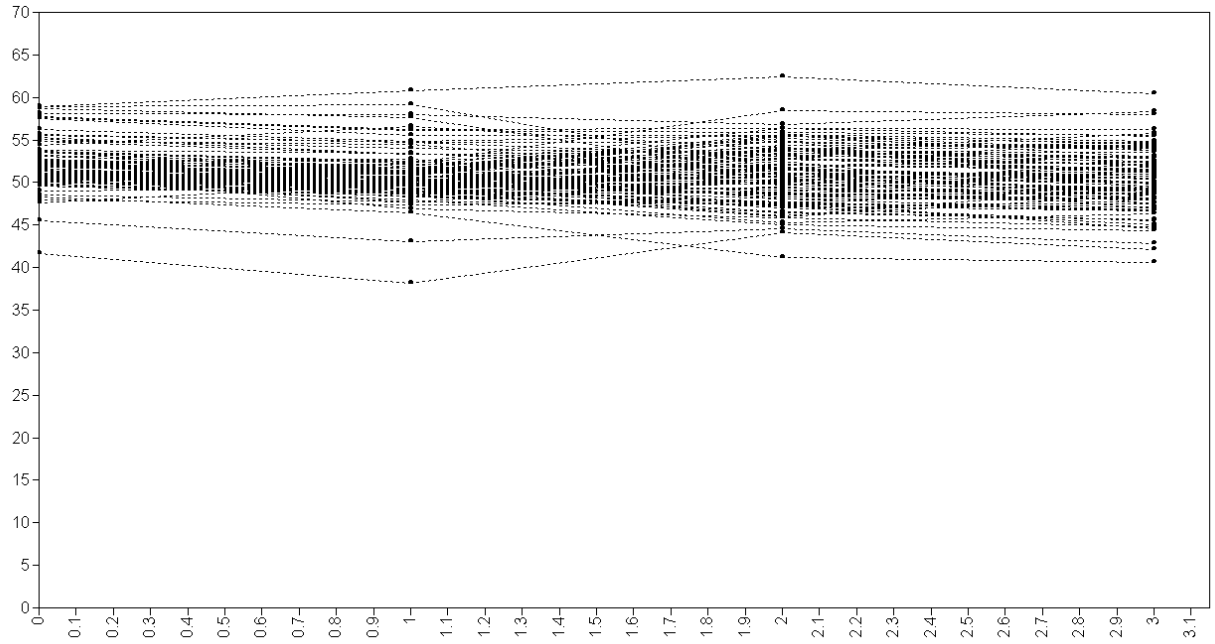
	MATHEMATICS			SCIENCE		
	***Elementary* Schools**	***Middle* Schools**	***High* Schools**	***Elementary* Schools**	***Middle* Schools**	***High* Schools**
Special Education Students						
2003/04	N = 3122 P = 1104	N = 5796 P = 1063	N = 5130 P = 898	N = 806 P = 124	N = 723 P = 135	N = 2112 P = 583
2004/05	N = 3833 P = 990	N = 4712 P = 962	N = 4023 P = 827	N = 561 P = 121	N = 814 P = 127	N = 2275 P = 507
2005/06	N = 4466 P = 1344	N = 5551 P = 874	N = 3507 P = 862	N = 551 P = 140	N = 714 P = 125	N = 2118 P = 585
2006/07	N = 4780 P = 1731	N = 6176 P = 1241	N = 4398 P = 1011	N = 544 P = 138	N = 700 P = 115	N = 2086 P = 683

	MATHEMATICS			SCIENCE		
	***Elementary* Schools**	***Middle* Schools**	***High* Schools**	***Elementary* Schools**	***Middle* Schools**	***High* Schools**
Limited English Proficiency Students						
2003/04	N = 16289 P = 6780	N = 16909 P = 4312	N = 14992 P = 3711	N = 1332 P = 93	N = 180 P = 25	N = 3466 P = 667
2004/05	N = 18001 P = 9071	N = 13878 P = 3765	N = 13342 P = 3811	N = 1663 P = 124	N = 180 P = 18	N = 4452 P = 687
2005/06	N = 18593 P = 8750	N = 14292 P = 3801	N = 12657 P = 3313	N = 1507 P = 179	N = 305 P = 73	N = 3901 P = 583
2006/07	N = 17909 P = 9307	N = 15044 P = 4845	N = 15687 P = 4700	N = 1616 P = 219	N = 306 P = 75	N = 2668 P = 543

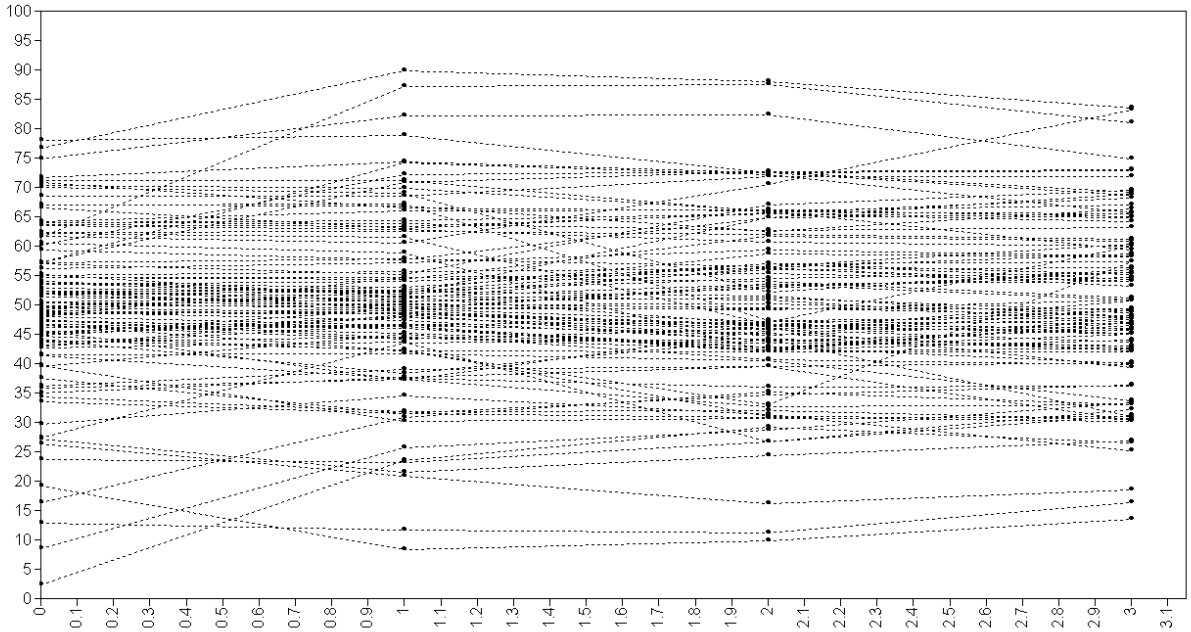
APPENDIX C

Growth Trajectories in Math and Science Proficiency Across Four Years (2003/04-2006/07) for Individual Schools at the Elementary, Middle, and High School Level [the school score is a weighted logit—natural logarithm of the odds for proficiency—presented in a T-scale format (*Mean* = 50, *SD* = 10)]

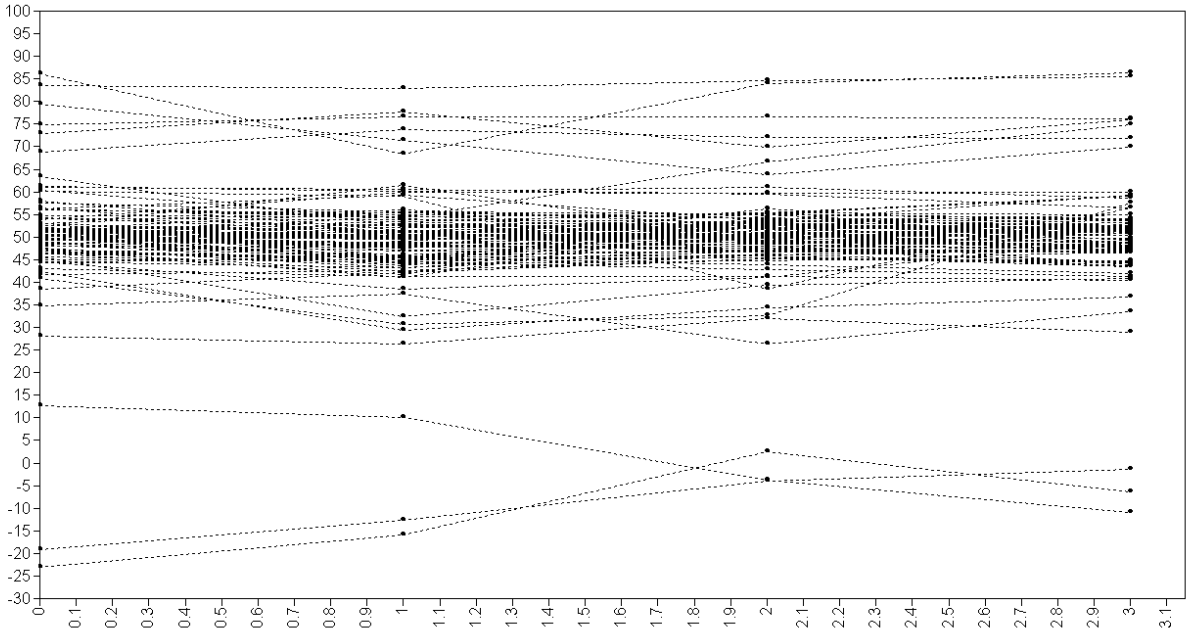
(a) Mathematics: Elementary Schools



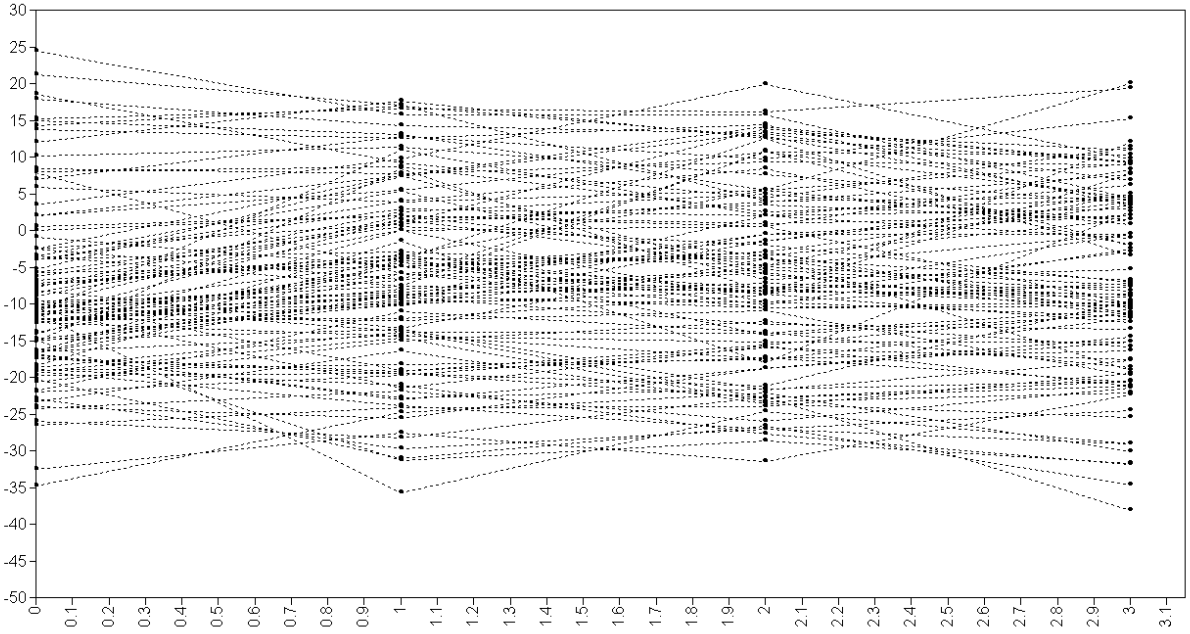
(b) Mathematics: Middle Schools



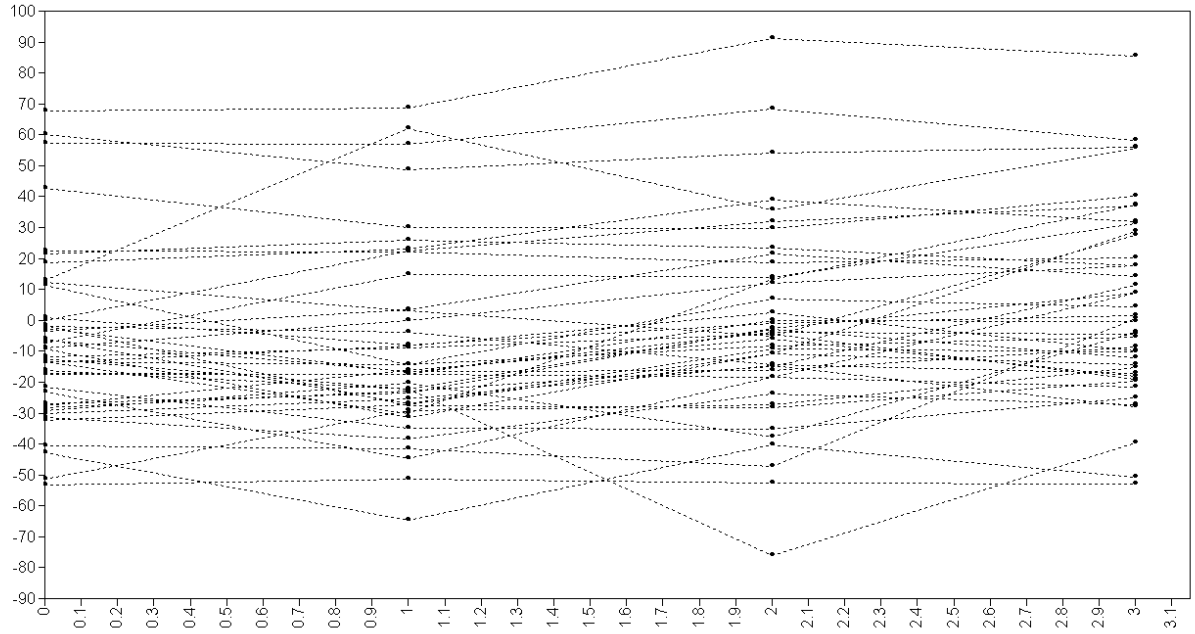
(c) Mathematics: High Schools



(d) Science: Elementary Schools



(e) Science: Middle Schools



(f) Science: High Schools