Educational Research Institute of America

A study of the Singapore math program, *Math in Focus*, state test results

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Summary

In a previous quasi-experimental, pretest/posttest study conducted by the Educational Research Institute of America (2010a) in 2009-2010, second and fourth graders enrolled in Old Bridge Township School District, a large New Jersey school district using the Singapore math program, *Math in Focus* as part of a district pilot of the program showed significant increases in math achievement over one academic year, as measured by the *Stanford Achievement Test, Ninth Edition* (SAT 9). *Math in Focus* is the U.S. edition of Singapore's premier program, which is used in over 85% of Singapore schools. The current study, which represents an extension of the 2009-2010 pilot study as it utilizes the same research sample and timeline of program use as 2010 state test scores were not yet available when the pilot study results were initially reported, sought to determine if similar gains would be seen if the outcome measure was the state mathematics test, the *New Jersey Assessment of Skills and Knowledge (NJ ASK): Mathematics*. Since the NJ ASK assessment is not administered to grade 2 students, only grade 4 NJ ASK test results could be analyzed for this study.

One hundred twenty-five fourth graders in Old Bridge Township School District were engaged in a pilot of the Singapore math program, *Math in Focus* during the 2009-2010 academic year; these students comprised the experimental group for this current study. The remaining 553 students in the district enrolled in grade 4 during the same period used an alternative instructional mathematics program and these students then comprised the control group for this study. Mathematics scores from the *New Jersey Assessment of Skills and Knowledge* (NJ ASK) administered in the spring of 2009 and the spring of 2010 were analyzed to determine if the students who used *Math in Focus* made significant gains over the course of the pilot year. The score gains attained by the experimental group were also compared to those attained by the control group students.

The experimental group sample of 125 students included classes taught by six different teachers from five different elementary schools within the district. Each of these teachers had volunteered to pilot the Singapore math program, *Math in Focus* for the 2009-2010 academic year. This was the first time the teachers had used the program

and most were unfamiliar with the program prior to the pilot. The remaining teachers in those five schools as well as all of the teachers in the other seven elementary schools in the district used the alternative mathematics program, and their students made up the control group for this study.

In the year before the pilot of the Singapore math program, *Math in Focus* began, all 678 students in all twelve elementary schools in the district used the same alternative program. Analyses of spring 2009 NJ ASK mathematics scores, which represent achievement prior to the *Math in Focus* pilot, show that there were no significant differences in performance between those students who the following year used *Math in Focus* (the experimental group for this study) and those students who did not (the control group). However, the analysis of the spring 2010 NJ ASK mathematics scores, which represent achievement after the year-long pilot of *Math in Focus*, showed that the average score of the experimental group—those students using *Math in Focus*--was significantly higher than that of the control group students who did not use the program.

Analyses of the performance level achievement showed that when the experimental group was divided into sub-groups of students who scored at the *Advanced Proficient Level*, the *Proficient Level*, and the *Partially Proficient Level* on the NJ ASK math test, all three sub-groups made statistically significant gains, and the *Partially Proficient Level* students increased the most.

In addition, in the current study a comparison was made between the 2010 SAT9 score results from the previous study and the 2010 NJ ASK scores. The results revealed strong correlations between scores on the two testing instruments. These correlations provide strength to the results in the previous ERIA study using only the Stanford Achievement Test (SAT9) as the outcome measure.

Introduction

We live in a mathematical world. Never before has the workplace demanded such complex levels of mathematical thinking and problem solving (National Council of Teachers of Mathematics, 2009). Clearly, those who understand and can do mathematics will have opportunities that others do not have. To address concerns that many U.S. students lack essential skills to be successful in mathematics-related careers, attention has turned toward alternative approaches to teaching mathematics (e.g., Hu, 2010). This is partly driven by comparisons of American students to their international peers. In terms of mathematical skills, the United States is quickly falling behind the rest of the developed world. Researchers comparing the math skills of students in industrialized nations report that U.S. students in grades 4 and 8 consistently performed below most of their peers around the world, a trend that continues into high school (Provasnik, Gonzales, & Miller, 2009). When it comes to Mathematics achievement, students from Singapore consistently outperform American students, and students from most other nations, on international tests of Mathematics, such as the Trends in International Math and Science Study (TIMSS) which show Singapore as a top performing nation for the past 15 years. (Gonzales et al., 2008; Provasnik et al., 2009).

Singapore's students' superior math achievement could be the result of the nation's unique approach to teaching the subject using a pedagogy that is quite distinct from the typical programs used in the United States (Ginsburg, Leinwand, & Decker, 2009). In general, the Singapore approach to math often includes covering fewer topics in greater detail at each grade level, with a focus on mastery, problem solving, building concepts and processes, and a strong emphasis on improving students' metacognition. The Singapore math framework and curriculum syllabus was one of the models used to develop the approved Common Core State Standards for Mathematics.

Math in Focus: Singapore Math

The Singapore math program, *Math in Focus* published by Marshall Cavendish Education-Singapore in partnership with Houghton Mifflin Harcourt, is the U.S. Edition of *My Pals are Here! Maths*—the program used by over 85% of the students in Singapore. The success of *My Pals are Here! Maths* is reflected in the Trends in International Math and Science Study (TIMSS) results, where Singapore has been a top performing nation over the past 15 years (Gonzales et al., 2008). *Math in Focus* follows the same scope, sequence and pedagogy as Singapore's My Pals are Here! *Maths*. U.S. enhancements include the addition of customary measurement, a traditional teacher's edition, technology components, differentiated resources for reteaching and enrichment, and transition components for easing U.S. students into the new approach.

Recent research on *Math in Focus* (see Great Source/Houghton Mifflin Harcourt, 2009) found that the program had a positive effect on student math achievement in the U.S. In addition to the results of a previous research conducted by the Educational Research Institute of America (2010a and 2010b) referenced within this report, which found the program had a positive effect on math achievement for grade 2 and 4 students in New Jersey, similar results were shown in a small scale pretest/posttest study in one school in Nebraska that used the Singapore math program, *Math in Focus*.

Research Design

Preliminary research on the Singapore math program, *Math in Focus* indicates that the program leads to significant improvement in American students' math achievement during the academic year. The previous studies, however, relied on nationally standardized tests. This study sought to determine if similar results would be seen when a state achievement test was used as the outcome measure. In the current study analyzed students' mathematics achievement as demonstrated by results from the *New Jersey Assessment of Knowledge and Skills* (NJ ASK) mathematics test in spring 2009, the test administration most prior to the year-long pilot of *Math in Focus* to the spring 2010, following one year of program use. Spring 2009 scores represent the pretest in this study and spring 2010 scores represent the posttest. One hundred twenty-five grade 4 students who used the *Math in Focus* program for a year comprised the experimental group and the remaining 553 grade 4 students in Old Bridge Township School District who did not use the program made up the control group.

Research Questions

The following questions guided the design of the study and the data analyses:

1. Do students using *Math in Focus* show significant gains in math achievement on the *New Jersey Assessment of Knowledge and Skills* (NJ ASK) mathematics test when using the *Math in Focus* program, and how do those gains compare to the achievement shown by students in a control group from the same school district using an alternative program?
2. Do students at varying levels of achievement achieve similar gains when using *Math in Focus*?
3. For students using the *Math in Focus* program, does performance on a state mathematics test, the *New Jersey Assessment of Knowledge and Skills* (NJ ASK), correlate with performance on a nationally standardized achievement test, the *Stanford Achievement Test, 9th edition* (SAT 9)?

Description of the Research Sample

The study was conducted in the Old Bridge Township School District in New Jersey. The township's public school system, with a student population of 10,047, ranks as one of the largest suburban school districts in the State of New Jersey. The district provides preschool through high school education, with facilities consisting of one high school with two campuses, two middle schools, and twelve elementary schools.

The district is classified by the New Jersey Department of Education as being in District Factor Group "FG", the fourth highest of eight groupings. District Factor Groups organize districts statewide to allow comparison by common socioeconomic characteristics of the local districts. From lowest socioeconomic status to highest, the categories are A, B, CD, DE, FG, GH, I and J.

The study utilized data collected from the district's 2009-2010 pilot of the Singapore math program, *Math in Focus*. The experimental group for the study consists of the 125 fourth-graders whose teachers (six total) voluntarily participated in the year-long pilot of *Math in Focus*. The control group consists of the other 553 fourth graders in the district whose teachers did not use the program.

Table 1 below provides a description of the demographic characteristics of the five schools in *Math in Focus* was piloted and of all 12 elementary schools in the Old Bridge Township district. Table 1 provides indication that there is little difference between the demographics of the schools in which *Math in Focus* was used and the demographics of all elementary schools in the district.

It is important to note that the school data does not provide a description of the make-up of the individual classes that comprised the research sample in the study. However, the tables do provide general descriptions of the schools and, thereby, an estimate of the demographic composition of the classes in the sample.

Table 1
Demographics of Schools Represented within Research Sample

Location	*Grades*	*Students Enrolled*	*Students Free/Reduced Lunch Programs*	*Minority*	*Students with Special Education Needs*
Schools represented within *Math in Focus* Group					
Urban Fringe Large City	K to 5	252	12%	30%	12%
Urban Fringe Large City	K to 5	384	16%	20%	12%
Urban Fringe Large City	K to 5	523	10%	24%	11%
Urban Fringe Large City	K to 5	340	6%	22%	11%
Urban Fringe Large City	K to 5	305	34%	53%	13%
Averages		**361**	**16%**	**30%**	**12%**
Schools represented within Control Group					
Urban Fringe Large City	K to 5	252	12%	30%	12%
Urban Fringe Large City	K to 5	384	16%	20%	12%
Urban Fringe Large City	K to 5	523	10%	24%	11%
Urban Fringe Large City	K to 5	340	6%	22%	11%
Urban Fringe Large City	K to 5	305	34%	53%	13%
Urban Fringe Large City	K to 5	291	6%	30%	14%
Urban Fringe Large City	K to 5	544	16%	34%	11%
Urban Fringe Large City	K to 5	251	9%	31%	12%
Urban Fringe Large City	K to 5	527	8%	36%	12%
Urban Fringe Large City	K to 5	241	18%	18%	12%
Urban Fringe Large City	K to 5	357	17%	21%	12%
Urban Fringe Large City	K to 5	321	19%	39%	12%
Averages		**339**	**14%**	**29%**	**12%**

Description of the Outcome Measures

The outcome measure for this study was the *New Jersey Assessment of Skills and Knowledge* (NJ ASK) mathematics test for grade 4.[1] Grade level specific assessments are administered each year to all New Jersey students in grades 3 to 8. The test is developed, administered, and scored under the direction of New Jersey Department of Education.

The content of the Grade 4 NJ ASK Mathematics test assesses students' ability to perform grade appropriate math from five general categories outlined in the state's academic standards for mathematics:

Standards and Strands	
4.1. Number and Numerical Operations A. Number Sense B. Numerical Operations C. Estimation **4.2. Geometry and Measurement** A. Geometric Properties B. Transforming Shapes C. Coordinate Geometry D. Units of Measurement E. Measuring Geometric Objects **4.3. Patterns and Algebra** A. Patterns and Relationships B. Functions C. Modeling D. Procedures	**4.4. Data Analysis, Probability, and Discrete Mathematics** A. Data Analysis (Statistics) B. Probability C. Discrete Mathematics--Systematic Listing and Counting D. Discrete Mathematics--Vertex-Edge Graphs and Algorithms **4.5 Mathematical Processes** A. Problem Solving B. Communication C. Connections D. Reasoning E. Representation F. Technology
All of the information regarding the NJ ASK assessments was collected from the New Jersey Department of Education website.	

The NJ ASK test results are provided in standard scores and the standard scores are used to rank students according to three achievement levels described below:

Partially Proficient Level

Students performing at the Partially Proficient level have limited recall, recognition and application of basic mathematical concepts, skills, and vocabulary to solve problems involving real world situations.

Proficient Level

Students performing at the Proficient level demonstrate recall, recognition and application of mathematical concepts, skills, and vocabulary to solve problems involving real world situations.

Advanced Proficient Level

Students performing at the Advanced Proficient level clearly and consistently demonstrate thorough conceptual understanding of procedural and analytical skills. In addition, Advanced Proficient students demonstrate the use of abstract thinking and provide explanations that are consistently clear and thorough. These students use both inductive and deductive reasoning to solve non-routine problems as well as consistently demonstrate the ability to abstract relevant information, use multiple strategies and/or reasoning methods, and use various forms of representations to solve complex problems. Advanced Proficient students demonstrate an understanding of the reasonableness of their answers.

The *Stanford Achievement Test: Mathematics* (SAT 9) was used in the previous ERIA study for this same population of students. In addition to the NJ ASK Mathematics scores used in the current study, the SAT9 scores from the previous study was used in the current to determine correlations between results on the two measures and if the correlations could provide a more robust indication of the instructional efficacy of the Singapore math program, *Math in Focus*.

The *Stanford Achievement Test Series, Ninth Edition* for Mathematics, Primary 3 level, was administered to the grade 4 students in the experimental group.

The following description of the *Stanford Achievement Test Series, Ninth Edition* test for Mathematics appears in the manual for test administrators:

> *The Stanford Abbreviated mathematics subtests assess the concepts and skills of mathematics within the context of realistic and engaging problems. The emphasis is on problems that require students to use logical reasoning, employ communication skills to recognize alternative representations of data, and implement non-routine problem-solving strategies. The mathematical content incorporated in these problems has also been refined to reflect the emphasis recommended by the NCTM.*
>
> *The Stanford Abbreviated mathematics subtests assess the entire breadth of mathematical content recommended by NCTM, including number theory, geometry, algebra, statistics, and probability. At Primary 1 through Advanced 2, two subtests are included: Problem Solving and Procedures.*

Data Analyses and Results

Data analyses and descriptive statistics were computed for the standard scores for both the pretest and posttest. The following analyses were conducted to determine answers to the research questions that were the guiding focus of this study:

1. Pretest/posttest comparisons, based on 2009 to 2010 scores on the NJ ASK mathematics test, were used to analyze growth for students that used *Math in Focus* and represented the experimental group for this study. Pretest/posttest results for the experimental group, the *Math in Focus* users, were then compared to the same results for the control group. Both groups' proficiency level achievement on the NJ ASK test was also compared.
2. Students in the experimental group were divided into three sub-groups based on the performance level at which their 2009 NJ ASK mathematics test scores placed them: 1) Advanced Proficient; 2) Proficient; and 3) Partially Proficient. The scores were then analyzed for these three sub-groups to compare achievement. Both chi-square analyses and analyses of variance were used to evaluate gains.
3. Correlation coefficients were computed to determine the strength of relationship between the NJ ASK mathematics test scores and the SAT 9 mathematics scores.

Research Question 1*:*

Do students using Math in Focus *show significant gains in math achievement on the* New Jersey Assessment of Knowledge and Skills *(NJ ASK) mathematics test when using the* Math in Focus *program, and how do those gains compare to the achievement shown by students in a control group from the same school district using an alternative program?*

In order to test for the significance of pretest scores, a Mixed Model Analysis of Variance was conducted with Math in Focus/Control group as the between subject variable and pretest and posttest scores as the within subject variable. Table 2 shows that the within subject variable (pretest/posttest scores) was statistically significant (≤.0001). In addition, the interaction of Math in Focus/Control group with the within subject factor was also significant (≤.0001).

Table 2
Mixed Model Analysis of Variance to Test the Interaction of Math in Focus/Control Group as a Between Subjects Factor and Pretest/Posttest Scores as a Within Subjects Factor

Test	***Mean Square***	**F-*test***	***Significance***
Pretest/Posttest	12826.360	51.431	≤.0001
Pretest/Posttest X Group	3956.449	15.865	≤.0001

Based on the finding that there was a significant interaction effect with pretest/posttest and Math in Focus/Control group, independent sample t-tests were computed to determine if significant differences existed between Math in Focus and control group students on the pretests and posttests. The 2009 and 2010 scores for students in the experimental and control groups were analyzed using an Independent Sample *t*-test. The results are provided in Table 3. The average scores for the two groups were not significantly different in 2009 prior to the use of the *Math in Focus* program. The mean 2009 scores were 233.8 for the group that would be using the *Math in Focus* program the following year and 230.4 for the control group.

However, comparison of the scores from 2010, after one year of *Math in Focus* program use by the experimental group, shows that there was a statistically significant difference (<.0001) favoring the *Math in Focus* group. The statistical significance was <.0001 indicating a difference that would have occurred by chance less than once out of 10,000 repetitions. It is clear that the *Math in Focus* program resulted in significant gains.

Table 3
Independent Sample Comparison *t*-test
Results Comparing the *Math in Focus* Group (N=125) and Control Group (N=553)
Students' Pretest and Posttest Standard Scores

Test	*Group*	*Mean Standard Score*	*SD*	*t*-test	*Significance*
2009 NJ ASK	*Math in Focus* (N=125)	233.8	34.5	1.004	Non-Significant
2009 NJ ASK	Control (N=553)	230.4	35.1		
2010 NJ ASK	*Math in Focus* (N=125)	246.2	31.4	3.563	<.0001
2010 NJ ASK	Control (N=553)	233.9	35.5		

A paired comparison *t*-test was then computed for each of the two groups. The results in Table 4 show that both groups increased statistically significantly. However, the mean score gain for the control group was 3.5 standard score points while the mean score gain for the *Math in Focus* group was 12.4 score points.

Table 4

Paired Sample Comparison *t*-test
Results Comparing the *Math in Focus* Group (N=125) and Control Group (N=553)
Students' Pretest and Posttest Standard Scores

Test	*Group*	*Mean Standard Score*	*SD*	*t*-test	*Significance*
2009 NJ ASK	Control (N=553)	230.4	35.1	3.649	<.0001
2010 NJ ASK	Control (N=553)	233.9	35.5		
2009 NJ ASK	*Math in Focus* (N=125)	233.8	34.5	6.733	<.0001
2010 NJ ASK	*Math in Focus* (N=125)	246.2	31.4		

In the analyses shown in Tables 3 and 4, student performance was examined without considering known variables that affect student achievement. Therefore, several student level factors were entered into the analysis to determine if the effect of *Math in Focus* remained significant when statistically controlling for those known predictors. Three variables were entered into the analysis 1. Student sex (dummy coded girls = 2, boys = 1); 2. ethnic background (dummy coded 1 Minority = 1, White/Caucasian = 2); 3. Teacher (dummy coded 1 to 6 for each teacher).

Table 5 shows that the only variable that had a significant effect was the effect due to using the *Math in Focus* program. The effect size for the three other variables, teacher, sex, and ethnicity, were not significant nor were any of the interactions significant. Neither were any of the interaction effects significant.

Table 5
Repeated Measures Analyses on *Math in Focus* Gains
Using Teacher, Sex, and Ethnicity as Controlling Factors

Factor	***Mean Square***	***F test***	***Significance***
Math in Focus (MIF) 2009 to 2010	6085.4	30.886	<.0001
MIF & Teacher	279.2	1.417	Non-Significant
MIF & Sex	1.6	.008	Non-Significant
MIF & Ethnicity	97.9	.497	Non-Significant
MIF & Teacher & Sex	243.3	1.235	Non-Significant
MIF & Teacher & Ethnicity	267.5	1.357	Non-Significant
MIF & Sex & Ethnicity	87.1	.442	Non-Significant
MIF & Teacher & Sex & Ethnicity	196.0	.995	Non-Significant

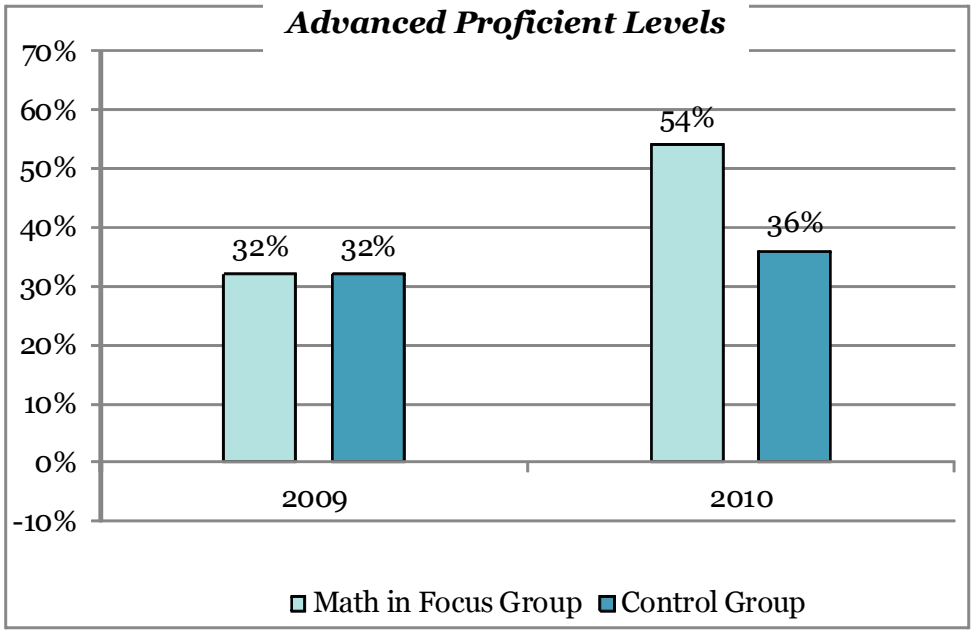
The results of the analyses reported in Tables 2, 3, and 4 provide evidence that the students using *Math in Focus* made statistically significant gains when compared to students in the control group who were using an alternative mathematics program. The improvement for the *Math in Focus* students existed when statistically controlling for student level variables known to affect student performance.

As an additional evaluation, Chi-Square analyses were conducted to determine if the increase in the number of students scoring at the Advanced Proficient levels increased for both the Math in Focus group and the Control group. The analyses were conducted separately for each of the two groups. The McNemar statistic was used to test the results. For the Math in Focus group the results were significant (<.0001) for the Math in Focus group test and non-significant for the Control group.

Figures 1 to 3 provide a graphic description of the differences in the gains from 2009 to 2010 for the experimental group using *Math in Focus* and the control group scoring at each of the three NJ ASK test performance levels. Figure 1 shows that the *Math in Focus* group increased by 20% at the highest level while the control group increased by only 4%.

Figure 1

Gains for *Math in Focus* Group and Control Group from 2009 to 2010 at the Advanced Proficient Level on the New Jersey Assessment of Skills and Knowledge (NJ ASK)



The desired outcome by the end of the study would be for more students to score in the higher categories and fewer at the lowest category, indicating an improvement in performance over the designated period. Figure 3 shows that the *Math in Focus* group decreased by 12% at the lowest level while the control group decreased by only 3%.

Figure 2
Gains for *Math in Focus* Group and Control Group from 2009 to 2010 at the Proficient Level on the New Jersey Assessment of Skills and Knowledge (NJ ASK)

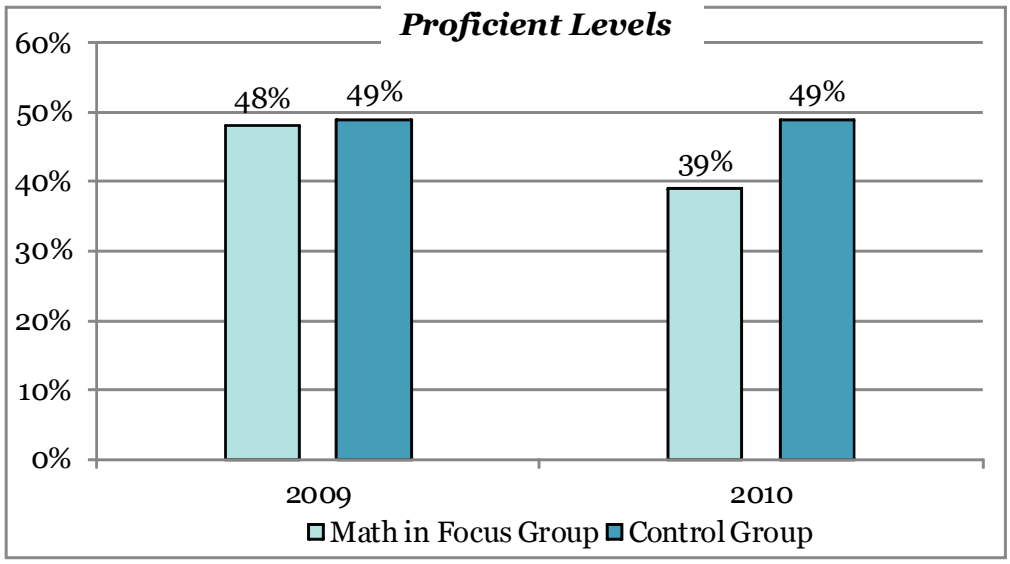
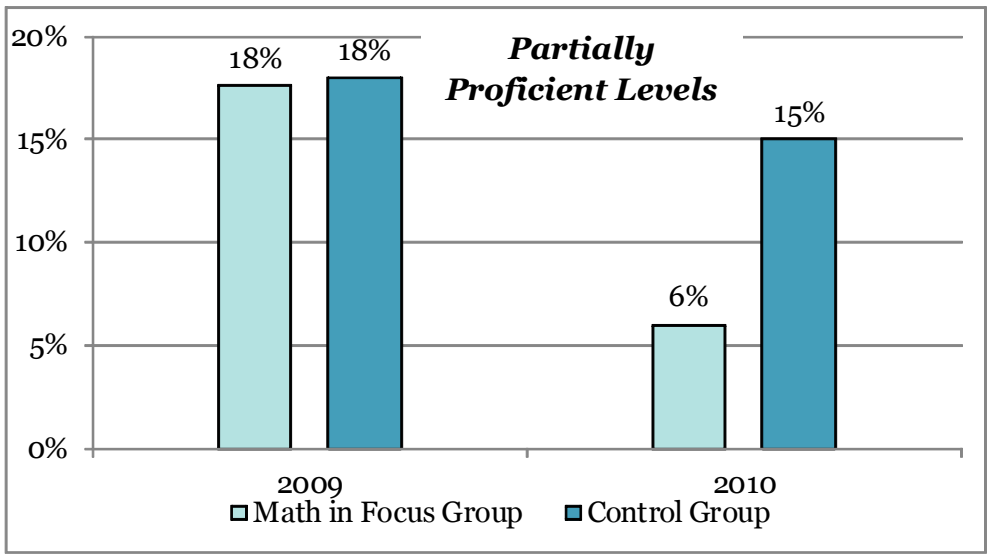


Figure 3
Gains for *Math in Focus* Group and Control Group from 2009 to 2010 at the Partially Proficient Level on the New Jersey Assessment of Skills and Knowledge (NJ ASK)



Research Question 2:

Do students at varying levels of achievement achieve similar gains when using Math in Focus*?*

Results for the *New Jersey Assessment of Knowledge and Skills* are reported as both standard scores and performance levels; students' scores are categorized into the three proficiency levels noted above: Partially Proficient, Proficient, and Advanced Proficient. These proficiency levels were used to sort the *Math in Focus* students into three achievement based sub-groups based for both 2009 and 2010. Average scores for each sub-group in each year were analyzed using a Pearson Chi-Square analysis and compared. The analyses showed that the 2009 to 2010 gains made by each sub-group were statistically significant (<.0001).

The desired trend would be to have more students scoring at the higher levels of proficiency and fewer at the lower levels. Table 6 clearly shows the large decline in the number of *Math in Focus* students scoring at the Partially Proficient level (from 22 to 8 students) and the large increase in students scoring at the Advanced Proficient level (from 43 to 68) from 2009 to 2010.

Table 6
Comparison of the Number of *Math in Focus* Students Scoring at Each of the Three NJ ASK Test Performance Levels from 2009 to 2010

	***New Jersey Assessment of Skills and Knowledge*: Proficiency Level Sub-Groups**		
Year of Testing	**Advanced Proficient**	**Proficient**	**Partially Proficient**
2009	43	60	22
2010	68	49	8

Paired Comparison *t*-tests for each of the three sub-groups were computed to test the statistical significance of the NJ ASK scores from 2009 to 2010. The three groups were divided based on their performance levels on the NJ ASK test for 2009.

Table 7 shows that all three groups increased from 2009 to 2010 and the increases for the Partially Proficient and the Proficient groups were statistically significant (<.0001) while the increase for the Advanced Proficient group was not statistically significant. The effect sizes using the Cohen *d* statistic were 1.24 and .94 for the Partially Proficient students and the Proficient students which are both large increases.

Table 7
Pretest/Posttest Comparison of Mean Standard Scores for Proficiency Level Sub-Groups

Test	*N*	*Mean Standard Score*	*SD*	*t*-test	*Significance*
Partially Proficient Level Sub-Group					
NJ ASK 2009	22	182.7	14.4	5.582	<.0001
NJ ASK 2010	22	201.8	16.4		
Proficient Level Sub-Group					
NJ ASK 2009	60	226.1	14.0	6.224	<.0001
NJ ASK 2010	60	242.2	19.8		
Advanced Proficient Level Sub-Group					
NJ ASK 2009	43	270.7	16.9	1.144	Non-Significant
NJ ASK 2010	43	274.3	19.2		

The analyses of the three sub-groups showed significant increases in the number of students scoring at the Advanced Proficient level and significant decreases in the percentage scoring at the Partially Proficient level. The results of these analyses provide further strong evidence that the *Math in Focus* program is effective with low scoring students as well as higher scoring students. The lack of statistical significance for the Advanced Proficient students is in part due to the fact that these students were already scoring at a high level on the 2009 NJ ASK assessments.

Research Question 3:

> *For students using the* Math in Focus *program, does performance on a state mathematics test, the New Jersey Assessment of Knowledge and Skills (NJ ASK), correlate with performance on a nationally standardized achievement test, the Stanford Achievement Test, 9th edition (SAT 9)?*

A regression analysis was computed to determine if the 2009 SAT 9 test scores and the 2010 SAT9 scores were significant predictors of the 2010 NJ ASK Mathematics scores.

A total of 121 fourth graders who used the *Math in Focus* program as part of the larger pilot and for whom all three scores-- 2009 SAT9, 2010 SAT9 and 2010 NJ ASK-- were available comprised the sample for this analysis; this represents a slightly smaller sample than the 125 students in the *Math in Focus* pilot. All of the 2009 SAT 9 sub-test scores, which included Problem Solving, Procedures, and the Total) were statistically significant predictors of 2010 NJ ASK Mathematics scores. Of the 2010 SAT 9 scores, Problem Solving and the Total score were both statistically significant predictors but the Procedures score was not a statistically significant predictor.

The reason that the Procedures score was not a statistically significant predictor in 2010 was because the scores on this test were quite high in 2010 and the limited range of scores curtailed the use of the score as a predictor. The correlations provided in Table 8 show how the SAT9 Problem Solving and Total scores for both 2009 and 2010 are strongly correlated to the NJ ASK scores. However, the Procedures scores in both 2009 and 2010 do not show as high correlations because of the high scores and limited distribution of the scores.

The results provide strong evidence that the NJ ASK Mathematics test results and the test results for students who were administered the SAT 9 in the spring of 2009 and the spring of 2010 are highly correlated. Moreover, the SAT 9 tests at both testing periods are significant predictors of the NJ ASK Mathematics test scores.

Table 8

Correlations between results on the SAT9 in 2009, SAT9 in 2010, and the NJ ASK Mathematics Test in 2010

		SAT9 2009			SAT9 2010			NJ ASK 2010
		Total	*Problem Solving*	*Procedures*	*Total*	*Problem Solving*	*Procedures*	*Standard Score*
SAT9 2009	*Total*	1.0	.90	.85	.61	.57	.38	**.72**
	Problem Solving		1.0	.53	.56	.58	.27	**.69**
	Procedures			1.0	.51	.40	.41	**.56**
SAT9 2010	*Total*				1.0	.84	.74	**.59**
	Problem Solving					1.0	.26	**.64**
	Procedures						1.0	**.24**

All of the correlations are statistically significant at the <.01 level of significance.
Correlations are based on a sample of 121 grade 4 students for whom 2009 and 2010 SAT 9 scores were available along with the NJ ASK Mathematics scores for 2010.

Conclusions

Previous research on the Singapore math program, Math in Focus indicated that using the program was associated with significant improvement in mathematics achievement over the course of the academic year (Educational Research Institute of America, 2010a, 2010b). That study used a nationally normed mathematics test as its outcome measure. No research had been completed using a state mathematics test. The results of the current study found that students using the Math in Focus program made significant gains on a state accountability test of mathematics achievement when compared to a control group of students from the same school district. In addition, significant gains were seen for students scoring at varying levels of mathematics proficiency prior to using the Math in Focus program.

In addition, only one previous Math in Focus study (Bucolo, 2010) had investigated students' achievement gains to assess whether the program produced significant results when controlling for student level variables. This study sought to also control such variables when gains were analyzed using a state mathematics achievement test. The results of this study paralleled those from the 2010 study conducted by Bucolo and showed that the Math in Focus achievement gains on a state mathematics test were not impacted by student level variables.

The current study also examined the relationship between scores on the Stanford Achievement Test, Ninth Edition (SAT9), a nationally normed test used in two previous studies of Math in Focus (ERIA, 2010a and 2010b) and a state mathematics achievement test, the New Jersey Assessment of Skills and Knowledge (NJ ASK). This study shows strong correlations between these two measures and thereby provides evidence that Math in Focus in the previous studies is effective in increasing NJ ASK Mathematics test scores.

Understanding what forms of instruction are the most effective for teaching mathematics is crucial so that students can understand and comprehend the subject, a skill necessary to remain competitive in this global world (National Council of Teachers of Mathematics, 2009). With students from Singapore being among the top international performers in this subject (Gonzales et al., 2008), it is possible that adopting Math in Focus will lead to improved student math achievement in the United States.

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