A Study of the Instructional Effectiveness of *CAMS & STAMS* ©2011

Curriculum Associates®, LLC

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Educational Research Institute of America

Educational Research Institute of America (ERIA) is an educational research and development company that contracts with textbook companies, state departments of education, and school districts to conduct educational program tryout studies, develop instructional materials, analyze tests and test scores, and conduct technical studies for educational assessments. ERIA was founded in 1999 as an outgrowth of Indiana University Center for Research and Development, entitled the Center for Innovation in Assessment. Over the past decade, ERIA has conducted development and research projects for over 20 publishers, state departments of education, and other agencies.

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Executive Summary

This study was designed to determine whether the **Comprehensive Assessment of Mathematics Strategies** and **Strategies to Achieve Mathematics Success (CAMS® & STAMS®)** ©2011 program published by Curriculum Associates improves students' mathematics skills and strategies. The program was designed to identify and provide instruction for students on identified mathematics strategies.

The study evaluated the efficacy of two levels of the eight-level program, grade 3 and grade 7. Twenty teachers from eight different schools using *CAMS & STAMS* across four different states, California, New York, North Carolina, and Ohio, participated in the study. The tryout schools included relatively high percentages of students enrolled in free and reduced lunch programs. All of the participating classes were designed to provide mathematics instruction for students who needed extra instruction in mathematics. At grade 3, a total of 196 students from the *CAMS & STAMS* treatment group and 47 students from the control group were able to be matched with *CAMS* pretest and post test scores for the data analyses. At grade 7, a total of 215 students from the *CAMS & STAMS* treatment group and 149 students from the control group were able to be matched with *CAMS* pretest and post test scores for the data analyses.

The pretests and post tests used in the study included both the Stanford Achievement Test, Ninth Edition (SAT-9), and pretests and post tests included in the *CAMS & STAMS* program. Results showed that all the tests were of reasonably high reliability to conduct analyses.

The grade 3 results showed that the *CAMS & STAMS* treatment group scored higher on the post tests of both the SAT-9 and the *CAMS* assessments than did the control group students. When the *CAMS & STAMS* treatment group was compared on pretest to post test gains on both the SAT-9 and the *CAMS* assessments, their scores increased statistically significantly. In addition, grade 3 students from the *CAMS & STAMS* treatment group who scored below the 50th percentile on the pretests had a much larger gain between pretest and post test scores than did students above the 50th percentile.

The results at grade 7 paralleled those at grade 3, as the *CAMS & STAMS* treatment group scored higher on the post tests of both the SAT-9 and the *CAMS* assessments than did the control group students. When the *CAMS & STAMS* treatment group was compared on pretest to post test gains on both the SAT-9 and the *CAMS* assessments, their scores increased statistically significantly. In addition, students at grade 7 who scored lower on the pretests had a much larger gain between pretest and post test scores than did students who scored higher on the pretests.

Overview of the Study

This report describes a study designed to determine the educational efficacy of a program developed to improve students' mathematics skills and strategies. The program, entitled *Comprehensive Assessment of Mathematics Strategies* and *Strategies to Achieve Mathematics Success* ©2011, is published by Curriculum Associates and is commonly referred to as *CAMS & STAMS.*

The *Comprehensive Assessment of Mathematics Strategies* and *Strategies to Achieve Mathematics Success* ©2011 program is designed for students enrolled in grades 1 to 8. Each level of the program includes a pretest and a post test to target instruction *(CAMS)* and a set of student lessons that provide scaffolded instruction to help students increase specific mathematics strategies *(STAMS)*.

A convenience sample of ten different schools was used for the study. Schools were sampled across four different states: California, New York, North Carolina, and Ohio. The study was conducted with students enrolled in grades 3 and 7, and the corresponding program levels were used in the study. The demographic data for the schools indicates that the *CAMS & STAMS* schools enrolled larger percentages of students in free and reduced lunch programs than did the control schools. *CAMS & STAMS* treatment groups and control groups were included at both grades 3 and 7. Schools in the *CAMS & STAMS* treatment group were existing users of the *CAMS & STAMS* program, and implemented the program according to the guidelines provided. Schools in the control group used various other types of instructional and assessment materials.

The tests used in the study included a nationally standardized test, the Stanford Achievement Test Series, Abbreviated Version, Ninth Edition (SAT-9) and the *CAMS & STAMS* program pretests and post tests.

SAT-9 pretest and post test matched scores were available for a total of 252 grade 3 students and 360 grade 7 students. *CAMS* pretest and post test matched scores were available for a total of 243 grade 3 students and 364 grade 7 students. A greater number of students participated in the program; however, only those students for whom a pretest and a post test match was available were included in the data analyses.

Study Background

Great interest has been expressed in the instructional programs used in those countries that outperform the United States in international comparisons of student mathematics achievement. In addition, the strong emphasis on mathematics achievement in the United States has brought about a search for more effective mathematics programs and for those that help students to master higher-level skills and strategies in mathematics.

A growing body of research over several decades has supported the idea that explicit and focused instruction on mathematics strategies improves students' use of these strategies— and, as a result, improves mathematics skill and performance on assessments of mathematics achievement.

The current focus on mathematics strategies is exemplified by the recent release of the *Common Core State Standards* developed under the direction of the National Governors Association (NGA) and the Council of Chief State School Officers (CCSSO). The standards have been approved by most states, which have agreed to adopt the standards. The mathematics strategies in the *CAMS & STAMS* program are a close match to the strategies delineated in the *Common Core State Standards*, which emphasize the strategies that are at the heart of mathematics and which many students seem to lack. A correlation chart detailing the skills and strategies addressed by the *CAMS & STAMS* program and the *Common Core State Standards* can be found in the *STAMS* Teacher Guide.

This study is focused on mathematics skills and strategy improvement as measured by the pretest to post test gains of students with whom the program is used. The *CAMS & STAMS* program focuses on a set of 16 mathematics topics. These topics vary by grade level, based on each chronological grade level's curricular needs. The *CAMS* part of *CAMS & STAMS* is primarily a testing program designed to identify the mathematics strategies with which students seem to need help. The *CAMS* program includes both pretests and post tests. Teachers use the *CAMS* pretests to identify the strategies on which students score low and need targeted instructional support. The *STAMS* program provides instruction on 16 topics focusing on specific mathematics skills and strategies. After identifying students' weakest mathematics areas with the *CAMS* pretest, teachers can use the appropriate lessons from the *STAMS* program to teach those strategies.

Research Questions

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

1. Does the *Comprehensive Assessment of Mathematics Strategies* and *Strategies to Achieve Mathematics Success* ©2011 program improve the mathematics skills and strategies of students at grades 3 and 7?

2. Is the *Comprehensive Assessment of Mathematics Strategies* and *Strategies to Achieve Mathematics Success* ©2011 program equally effective in improving the mathematics skills and strategies of lower-performing students as well as higher-performing students at grades 3 and 7?

This report provides the study results in four major sections as follows:

- Grade 3 SAT-9 Test Comparisons

- Grade 3 *CAMS* Assessment Comparisons

- Grade 7 SAT-9 Test Comparisons

- Grade 7 *CAMS* Assessment Comparisons

Description of the Research Sample

A convenience sample of ten schools was used for the study. At grade 3, six schools were used for the *CAMS & STAMS* treatment group as well as part of the control group, and two additional schools were used solely for the control group. At grade 7, two schools were used for the *CAMS & STAMS* treatment group, one of which also had students who formed the control group.

Table 1 provides a summary of the demographic characteristics of the schools included in the study. Compared with the control schools, the data for the six schools that provided students for the grade 3 *CAMS & STAMS* treatment group indicates that these six schools have somewhat larger percentages of students in free and reduced lunch programs, a fairly strong indicator of socio-economic status. The data for the two schools that provided students for the grade 7 *CAMS & STAMS* treatment group indicates that these schools have about the same percentage of students in free/reduced lunch programs as the control school.

It is important to note that the school data does not provide a description of the make-up of each class that participated in the study. However, the school data does provide general descriptions of the school and thereby reasonable estimates of the demographic characteristics of the classes included in the study.

Table 1
Demographic Characteristics of the Participating Schools

Location	Grades	Students Enrolled	Students in Free/ Reduced Lunch Programs	Minority Students	Special Education Students
CAMS & STAMS **Schools Grade 3**					
Large Central City	PK to 8	666	90%	96%	20%
Large Central City	K to 8	329	91%	99%	18%
Urban Fringe Mid-Size City	K to 4	427	0	1%	10%
Urban Fringe Mid-Size City	K to 5	449	22%	6%	17%
Urban Fringe Mid-Size City	K to 5	416	31%	6%	15%
Urban Fringe Mid-Size City	K to 5	377	65%	99%	8%
Average		444	50%	51%	15%
Control Schools Grade 3					
Mid-Size City	K to 5	350	36%	7%	15%
Urban Fringe Mid-Size City	K to 4	427	0	1%	10%
Urban Fringe Mid-Size City	K to 5	422	31%	6%	15%
Average		399	22%	5%	13%
CAMS & STAMS **Schools Grade 7**					
Large Central City	6 to 8	284	64%	99%	0
Mid-Size Central City	6 to 8	1181	73%	39%	13%
Average		732	69%	69%	7%
Control School Grade 7					
Mid-Size Central City	6 to 8	1181	73%	39%	13%
Average		1181	73%	39%	13%

Description of the *CAMS & STAMS* Program

The following description of the *CAMS & STAMS* program was provided by the program publisher:

The *CAMS® & STAMS®* Series is a comprehensive resource that allows you to identify and teach essential mathematics skills and strategies. The *CAMS* Series is the assessment component and the *STAMS* Series is the instruction component.

CAMS® Series

The *CAMS* Series is a diagnostic mathematics series that allows you to identify and assess a student's level of mastery for each of 16 mathematics topics. It contains Pretests, Benchmarks, and Post Tests. This eight-level series is designed for students in grades 1 through 8. The *CAMS* Series helps teachers place students in the companion *STAMS* Series for mathematics instruction and remediation.

STAMS® Series

The *STAMS* Series provides instruction that is highly scaffolded and visually appealing lessons designed specifically to support struggling students.

- Five-part lessons provide focus and depth on each topic

- As students move through each five-part lesson, support is gradually removed to build student independence

- At each stage of the lesson, students become more accountable for their learning

- Students solve increasingly challenging problems as they move through each lesson

- Each lesson includes instruction and practice in answering multiple-choice, extended-response, and short-response questions

Description of the Assessments

Stanford Achievement Test, Ninth Edition

The Stanford Achievement Series includes thirteen battery levels that assess students from kindergarten through grade 12. The Stanford Abbreviated version was used in this study. At grade 3, the Primary 3 Level of the test was used. The subtests included 20 Mathematics: Procedures questions and 30 Mathematics: Problem Solving questions for a total of 50 test questions. At grade 7, the Intermediate 3 Level of the test was used. The subtests included 20 Mathematics: Procedures questions and 30 Mathematics: Problem Solving questions for a total of 50 questions. The test items on both tests were multiple-choice format items.

CAMS

The *CAMS* pretest and post test assessments each include a total of 80 multiple-choice test items focused on key foundational math skills, which align to NCTM Focal Points and Connections. Each test comprises 5 items for each of 16 strategies. The grade 3 and grade 7 strategies are listed below:

Grade 3 (Book C)	Grade 7 (Book G)
1. Place Value	1. Understand Integers
2. Add and Subtract	2. Add and Subtract Integers
3. Multiplication Concepts	3. Multiply and Divide Integers
4. Fact Strategies	4. Evaluate Expressions
5. More Fact Strategies	5. Solve Linear Equations
6. Division Concepts	6. Equations with Rational Numbers
7. Fact Families	7. Proportional Relationships
8. Fraction Concepts	8. Solve Proportions
9. Model Equivalent Fractions	9. Rate Problems
10. Benchmark Fractions	10. Percent as a Ratio
11. Compare Fractions	11. Percent Problems
12. Fractions Greater Than 1	12. Similarity
13. Plane Figures	13. Circles
14. Length	14. Cylinders
15. Perimeter	15. Circle Graphs
16. Pictographs and Bar Graph	16. Theoretical Probability

Description of Implementation and Data Collection Procedures

Participating schools had purchased copies of the *CAMS & STAMS* program for the 2010–2011 school year. Schools were asked to implement the *CAMS* assessment and to use the *STAMS* program for instruction throughout the school year as outlined in the *CAMS & STAMS* implementation guidelines. Schools were also asked to implement the pretests and post tests for *CAMS* and the SAT-9 with both the treatment group and the control group at the beginning and end of the school year.

Due to the inter-state nature of the sample, implementation dates varied from site to site. Pretests were generally administered in September 2010, and post tests were generally administered in April 2011. Schools in the *CAMS & STAMS* treatment group used the program about four times per week, and each administration ranged from 20–40 minutes.

At the end of the school year, schools returned their assessment results via mail to ERIA. These results were subsequently entered into a spreadsheet for analysis. All unique student and site identifiers were removed for anonymity purposes.

Test Statistics

Table 2 provides the statistical analysis for the grade 3 post test results for both the SAT-9 and the *CAMS* assessments. Reliabilities were calculated using the Kuder-Richardson Formula 20 (KR-20). The results show that the reliabilities of the tests were all above .85, indicating that the tests provide reliable data for statistical analyses.

Table 2
Grade 3 Post Test
SAT-9 and *CAMS* Statistics

Test	Standard Deviation (SD)	KR-20*	SEM**
***CAMS & STAMS* Treatment Group**			
SAT-9	8.63	.89	2.9
CAMS	14.20	.93	3.8
Control Group			
SAT-9	8.31	.91	2.5
CAMS	15.63	.94	3.8

*Reliabilities were calculated using the Kuder-Richardson Formula 20 (KR-20). KR-20, first published in 1937, is a measure of internal consistency reliability for measures with dichotomous choices.

**SEM stands for Standard Error of Measurement.

Table 3 provides the statistical analysis for the grade 7 post test results for both the SAT-9 and the *CAMS* assessments. The results show that the reliabilities of the tests were all above .85, indicating that the tests provide reliable data for statistical analyses.

Table 3
Grade 7 Post Test
SAT-9 and *CAMS* Statistics

Test	Standard Deviation (SD)	KR-20*	SEM**
***CAMS & STAMS* Treatment Group**			
SAT-9	11.86	.94	2.9
CAMS	12.23	.89	4.1
Control Group			
SAT-9	8.77	.89	2.9
CAMS	10.27	.85	4.0

*Reliabilities were calculated using the Kuder-Richardson Formula 20 (KR-20). KR-20, first published in 1937, is a measure of internal consistency reliability for measures with dichotomous choices.

**SEM stands for Standard Error of Measurement.

Data Analyses

The two assessments used for this study included a nationally standardized assessment, the Stanford Achievement Test, Ninth Edition, Abbreviated Version (SAT-9), published by Pearson Assessment. The SAT-9 Primary 3 Level was used with the grade 3 students. At grade 7 the Intermediate 3 Level was used. The second test was the *CAMS* assessment that is included as part of the *CAMS & STAMS* program.

After the teachers administered the tests, the answer documents were returned to ERIA for analysis. Data analyses and descriptive statistics were computed for each of the sets of pretests and post tests. Standard scores provided in the SAT-9 National Norm Data booklets were used for analyses. For the *CAMS* assessment, standard scores were computed using a mean of 300 and a standard deviation of 50. This was done to provide a more normal distribution of scores.

Independent sample *t*-tests were used to compare the post tests of the *CAMS & STAMS* treatment group to the control group. Paired sample *t*-tests were used to compare the pretest and post test scores of the *CAMS & STAMS* treatment group using both the SAT-9 and *CAMS* assessment. The ≤.05 level of significance was used as the level at which increases would be considered statistically significant for all of the statistical tests.

For both grades 3 and 7, matched pretest to post test scores for the *CAMS & STAMS* treatment group were split into two groups—high and low scorers—based on pretest scores. Paired sample *t*-tests were used to compare pretest to post test performance to determine if the program is equally effective with lower pretest scorers and higher pretest scorers.

An effect-size analysis was computed for the independent sample *t*-tests as well as for each of the paired sample *t*-tests. Cohen's *d* statistic was used to determine the effect size. This statistic provides an indication of the strength of the effect of the treatment regardless of the statistical significance. Cohen's *d* statistic is interpreted as follows:

    .2 = small effect

    .5 = medium effect

    .8 = large effect

Grade 3 SAT-9 Assessment Comparisons
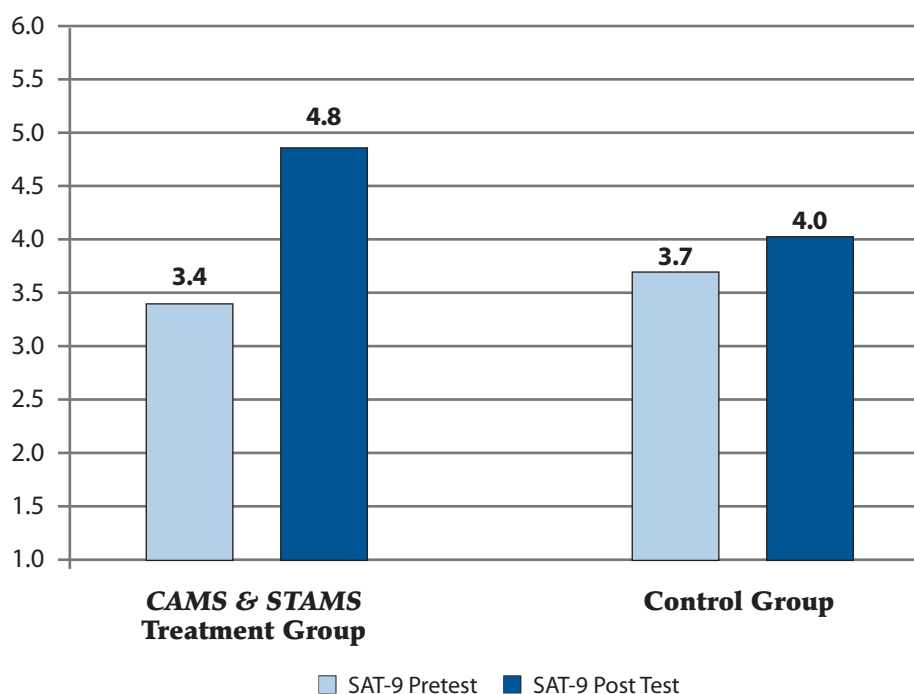
CAMS & STAMS and Control Group

Post test scores on the SAT-9, Primary 3 for the *CAMS & STAMS* treatment group and the control group were compared using an independent sample *t*-test. Table 4 provides the results showing that the *CAMS & STAMS* treatment group scored statistically significantly higher than the control group (≤.05) on the post tests. The effect size was small.

Table 4
Grade 3 *CAMS & STAMS* Treatment Group and Control Group
SAT-9 Post Test
Independent Sample *t*-Test Comparisons

Group	Number of Students	Mean Standard Score	SD	*t*-Test	Significance	Effect Size
CAMS & STAMS	180	614	40.9	1.944	≤.05	.30
Control	72	603	32.3			

The average grade equivalent score from the SAT-9 post test was 4.8 for the *CAMS & STAMS* treatment group and 4.0 for the control group. Figure 1 provides a comparison of the grade equivalent pretest and post test scores for the *CAMS & STAMS* treatment group and the control group.

Figure 1
Grade 3 *CAMS & STAMS* Treatment Group and Control Group
SAT-9 Post Test
Grade Equivalent Score Comparisons

CAMS & STAMS Group Pretest/Post Test Scores

A paired sample *t*-test was used to compare the pretest and post test scores for the *CAMS & STAMS* group. SAT-9 standard scores were used for the comparison. Table 5 shows that the gain in mean standard score from pretest to post test was statistically significant (≤.0001) and the effect size was large.

Table 5
Grade 3 *CAMS & STAMS* Treatment Group
SAT-9 Pretest and Post Test
Paired Sample *t*-Test Comparisons

Test	Number of Students	Mean Standard Score	SD	*t*-Test	Significance	Effect Size
Pretest	180	584	34.7	14.835	≤.0001	.80
Post Test	180	614	40.9			

CAMS & STAMS Lower/Higher Pretest Groups

The final analysis for the SAT-9 results was to compare the students who scored lower on the pretests to those who scored higher on the pretests to determine if the lower scoring students made gains as great as the higher scoring students. The 180 grade 3 students in the *CAMS & STAMS* treatment group were divided into two equal groups of 90 students based on their pretest scores on the SAT-9 assessment. Students who scored below the 50th percentile were assigned to the lower scoring group, while those who scored at the 50th percentile or higher were assigned to the higher scoring group. The lower scoring group had a mean standard score of 557 and scores ranged from 463 to 579. The higher scoring group had a mean standard score of 611 and their scores ranged from 579 to 682.
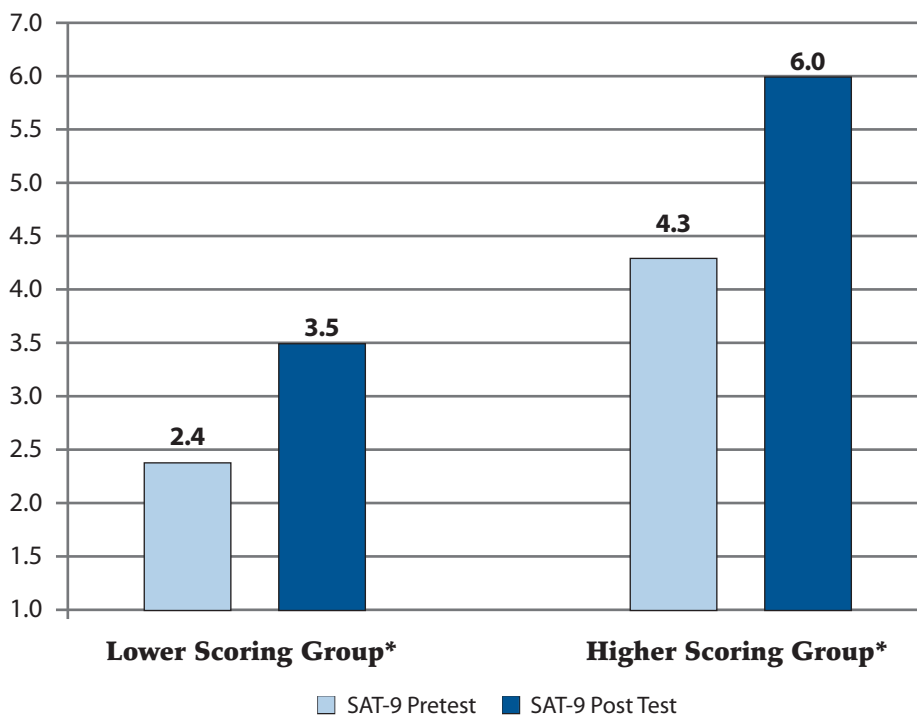
A paired sample *t*-test was used to compare each group's pretest scores to their post test scores. SAT-9 standard scores were used for the comparison. Table 6 shows that the gain in mean standard score from pretest to post test was statistically significant (≤.0001) for both groups. The effect size for both groups was large.

Table 6
Grade 3 *CAMS & STAMS* Lower Scoring Group and Higher Scoring Group
SAT-9 Pretest and Post Test
Paired Sample *t*-Test Comparisons

Group	Number of Students	Mean Standard Score	SD	*t*-Test	Significance	Effect Size
Lower Scoring Group						
Pretest	90	557	21.8	10.531	≤.0001	1.21
Post Test	90	589	30.2			
Higher Scoring Group						
Pretest	90	611	22.1	10.482	≤.0001	.96
Post Test	90	639	34.7			

Figure 2 provides a comparison of the grade equivalent score increases for the lower and higher pretest scoring groups. The figure shows that the increase in average grade equivalency for the lower scoring group was 1 year and 1 month, while the increase for the higher scoring group was 1 year and 7 months. Both groups made statistically significant gains that were greater than the equivalent of one full chronological grade.

Figure 2
Grade 3 *CAMS & STAMS* Lower Scoring Group and Higher Scoring Group
SAT-9 Grade Equivalent Score Comparisons

Difference statistically significant at ≤.0001

Grade 3 *CAMS* Assessment Comparisons

CAMS & STAMS and Control Group

The statistical significance of pretest to post test standard score differences for both the *CAMS & STAMS* treatment group and the control group on the *CAMS* assessment was compared using a paired sample *t*-test. Table 7 provides the results showing that both the *CAMS & STAMS* group and the control group made statistically significant gains (≤.0001). However, the effect size was large for the *CAMS & STAMS* treatment group, while the effect size for the control group was medium.

Table 7
Grade 3 *CAMS & STAMS* Treatment Group and Control Group
CAMS Pretest and Post Test
Paired Sample *t*-Test Comparisons

Group	Number of Students	Mean Standard Score	SD	*t*-Test	Significance	Effect Size
CAMS & STAMS Group						
Pretest	196	280	44.1	13.915	≤.0001	.82
Post Test	196	319	48.3			
Control Group						
Pretest	47	284	45.4	4.294	≤.0001	.67
Post Test	47	316	50.0			

CAMS & STAMS Lower/Higher Pretest Groups

Further analysis of the *CAMS* assessment results compared pretest and post test scores for the students who scored highest on the pretests to those who scored lowest on the pretests. The 196 grade 3 students in the *CAMS & STAMS* treatment group were divided into two groups of 98 students based on their pretest scores on the *CAMS* assessment. The lower scoring group had a mean standard score of 244 on the pretest and scores ranged from 166 to 278. The higher scoring group had a mean standard score of 317 on the pretest and their scores ranged from 278 to 386.
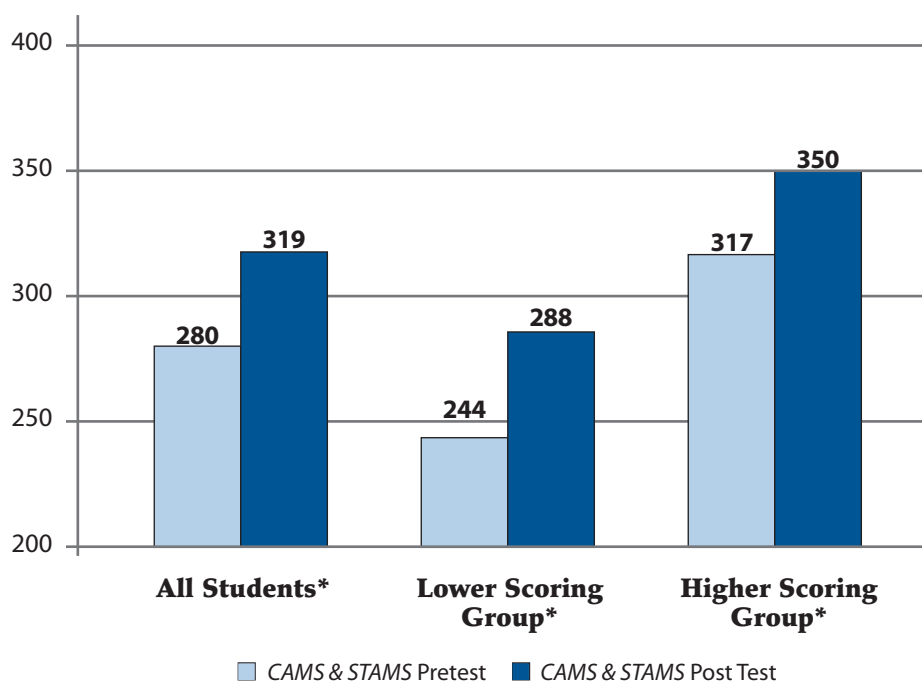
A paired sample *t*-test was used to compare the pretest scores for both groups to their post test scores. Table 8 on page 16 shows that the gain from pretest to post test for both groups was statistically significant (≤.0001). In addition, the effect size for both groups was large.

Table 8
Grade 3 *CAMS & STAMS* Lower Scoring Group and Higher Scoring Group
***CAMS* Pretest and Post Test**
Paired Sample *t*-Test Comparisons

Group	Number of Students	Mean Standard Score	SD	t-Test	Significance	Effect Size
Lower Scoring Group						
Pretest	98	244	22.5	10.179	≤.0001	1.34
Post Test	98	288	40.8			
Higher Scoring Group						
Pretest	98	317	27.5	9.857	≤.0001	1.05
Post Test	98	350	35.0			

Figure 3 provides a comparison of the increases in mean standard score for the total group, the lower scoring group, and the higher scoring group. All three groups made statistically significant gains. The figure shows that the increase in the mean standard score for the total group was 39 standard score points. The lower scoring group increased 44 standard score points, and the higher scoring group increased 33 standard score points.

Figure 3
Grade 3 *CAMS & STAMS* Lower Scoring Group and Higher Scoring Group
***CAMS* Pretest and Post Test Comparisons**

Difference statistically significant at ≤.0001

Grade 7 SAT-9 Assessment Comparisons
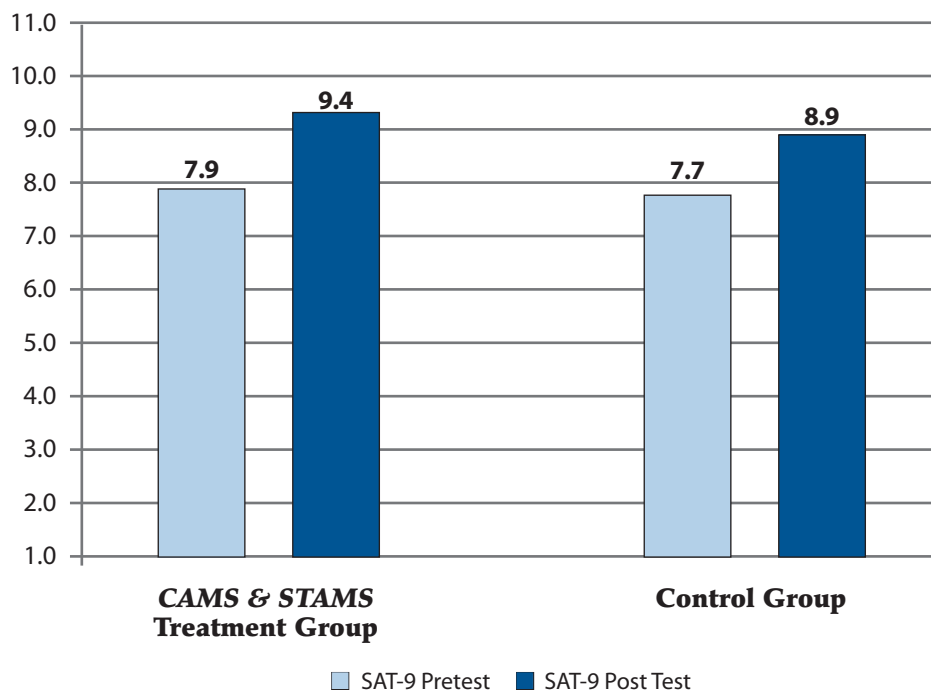
CAMS & STAMS and Control Group

Post test scores on the SAT-9, Intermediate 3 for the *CAMS & STAMS* treatment group and control group were compared using an independent sample *t*-test. Table 9 provides the results showing that the *CAMS & STAMS* treatment group scored statistically significantly higher than the control group (≤.0001) on the post tests. The effect size was small.

Table 9
Grade 7 *CAMS & STAMS* Treatment Group and Control Group
SAT-9 Post Test
Independent Sample *t*-Test Comparisons

Group	Number of Students	Mean Standard Score	SD	t-Test	Significance	Effect Size
CAMS & STAMS	212	689	33.2	4.031	≤.0001	.42
Control	148	673	42.4			

The average grade equivalent score on the SAT-9 post test was 9.4 for the *CAMS & STAMS* treatment group and 8.9 for the control group. Figure 4 provides a comparison of the grade equivalent pretest and post test scores for the *CAMS & STAMS* treatment group and the control group.

Figure 4
Grade 7 *CAMS & STAMS* Treatment Group and Control Group
SAT-9 Grade Equivalent Score Comparisons

CAMS & STAMS Group Pretest/Post Test Scores

A paired sample *t*-test was used to compare the pretest and post test scores for the *CAMS & STAMS* group. SAT-9 standard scores were used for the comparison. Table 10 shows that the gain in mean standard score from pretest to post test was statistically significant (≤.0001) and the effect size was medium.

**Table 10
Grade 7 CAMS & STAMS Treatment Group
SAT-9 Pretest and Post Test
Paired Sample t-Test Comparisons**

Test	Number of Students	Mean Standard Score	SD	*t*-Test	Significance	Effect Size
Pretest	212	664	31.1	16.884	≤.0001	.78
Post Test	212	689	33.2			

CAMS & STAMS Lower/Higher Pretest Groups

The final analysis for the SAT-9 results was to compare the students who scored lower on the pretests to those who scored higher on the pretests to determine if the lower scoring students made gains as great as the higher scoring students. The 212 grade 7 students in the *CAMS & STAMS* treatment group were divided into two equal groups of 106 students based on their pretest scores on the SAT-9 assessment. The lower scoring group had a mean standard score of 638 and scores ranged from 580 to 666. The higher scoring group had a mean standard score of 689 and their scores ranged from 666 to 716.
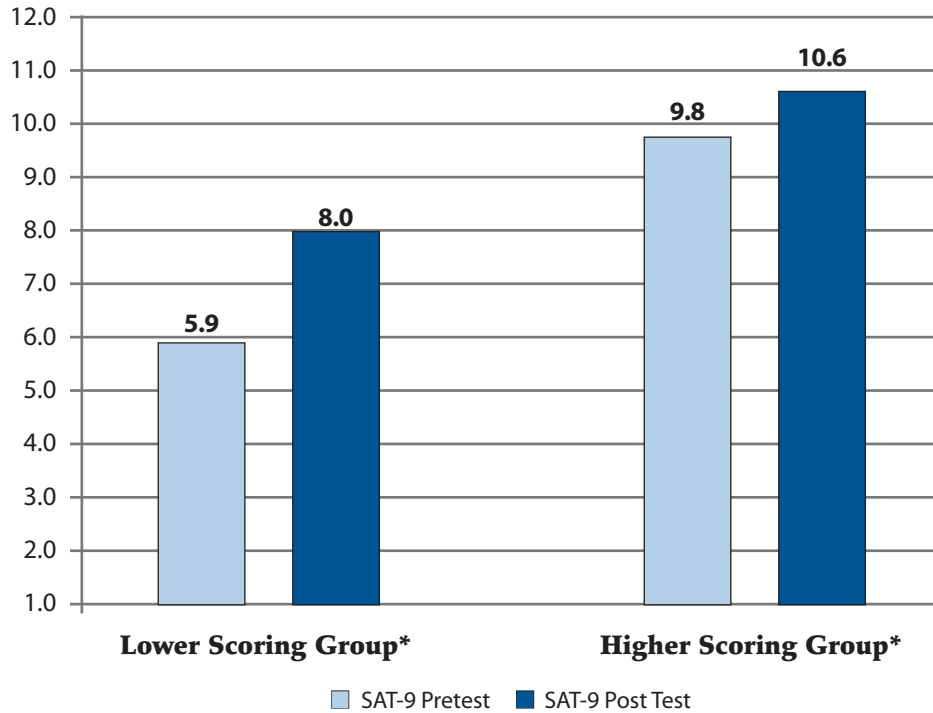
A paired sample *t*-test was used to compare each group's pretest scores to their post test scores. SAT-9 standard scores were used for the comparison. Table 11 shows that the gain in mean standard score from pretest to post test was statistically significant (≤.0001) for both groups. The effect size for both groups was large.

**Table 11
Grade 7 CAMS & STAMS Lower Scoring Group and Higher Scoring Group
SAT-9 Pretest and Post Test
Paired Sample t-Test Comparisons**

Group	Number of Students	Mean Standard Score	SD	*t*-Test	Significance	Effect Size
Lower Scoring Group						
Pretest	106	638	20.9	11.811	≤.0001	1.24
Post Test	106	668	27.1			
Higher Scoring Group						
Pretest	106	689	14.5	13.130	≤.0001	1.12
Post Test	106	711	23.6			

Figure 5 provides a comparison of the grade equivalent score increases for the lower and higher pretest scoring groups. The figure shows the increase in average grade equivalency for the lower scoring group was 2 years and 1 month, while the increase for the higher scoring group was 8 months. Both groups made statistically significant gains.

Figure 5
Grade 7 *CAMS & STAMS* Lower Scoring Group and Higher Scoring Group SAT-9 Grade Equivalent Score Comparisons

Difference statistically significant at ≤.0001

Grade 7 *CAMS* Assessment Comparisons

CAMS & STAMS and Control Group

The statistical significance of pretest to post test standard score differences for both the *CAMS & STAMS* treatment group and the control group on the *CAMS* assessment was compared using a paired sample *t*-test. Table 12 provides the results showing that both the *CAMS & STAMS* group and the control group made statistically significant gains (≤.0001). However, the effect size was medium for the *CAMS & STAMS* treatment group, while the effect size for the control group was small.

Table 12
Grade 7 *CAMS & STAMS* Treatment Group and Control Group
***CAMS* Pretest and Post Test**
Paired Sample *t*-Test Comparisons

Group	Number of Students	Mean Standard Score	SD	*t*-Test	Significance	Effect Size
***CAMS & STAMS* Group**						
Pretest	215	282	46.4	13.133	≤.0001	.73
Post Test	215	318	51.8			
Control Group						
Pretest	149	294	47.6	2.880	≤.005	.26
Post Test	149	306	44.4			

CAMS & STAMS Lower/Higher Pretest Groups

Further analysis of the *CAMS* assessment results compared the students who scored highest on the pretests to those who scored lowest on the pretests. The 215 grade 7 students in the *CAMS & STAMS* treatment group were divided into two groups—one group of 107 students and another group of 108 students—based on their pretest scores on the *CAMS* assessment. The lower scoring group had a mean standard score of 246 and scores ranged from 190 to 272. The higher scoring group had a mean standard score of 317 and their scores ranged from 272 to 445.
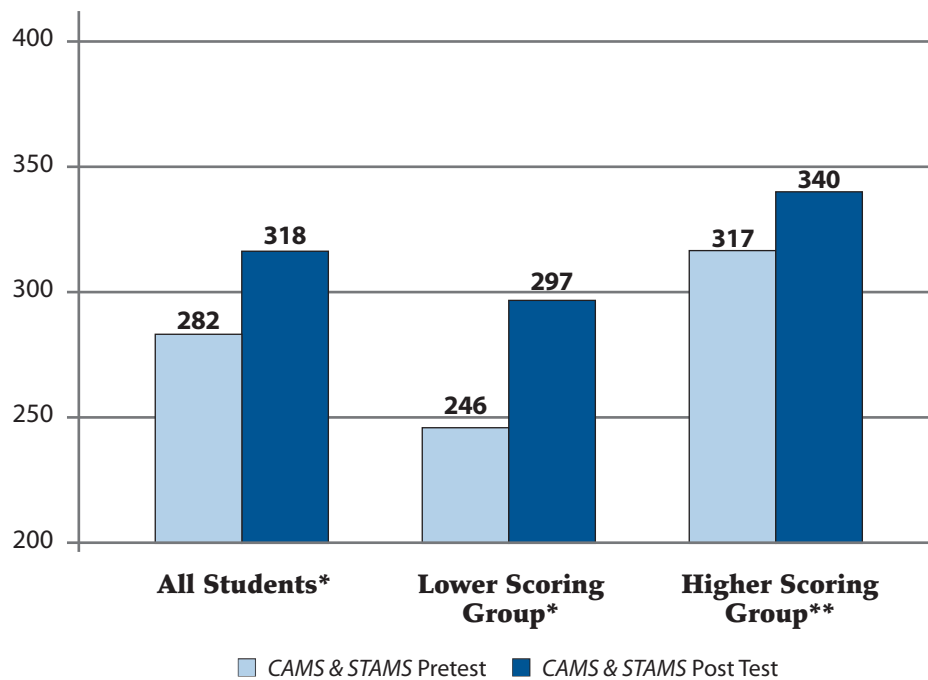
A paired sample *t*-test was used to compare the pretest scores for both groups to their post test scores. Table 13 on page 21 shows that the gain from pretest to post test for both groups was statistically significant (≤.0001). In addition, the effect size for the lower scoring group was large, and for the higher scoring group the effect size was medium.

Table 13
Grade 7 *CAMS & STAMS* Lower Scoring Group and Higher Scoring Group
CAMS Pretest and Post Test
Paired Sample *t*-Test Comparisons

Group	Number of Students	Mean Standard Score	SD	t-Test	Significance	Effect Size
Lower Scoring Group						
Pretest	107	246	17.4	11.775	≤.0001	1.52
Post Test	107	297	44.3			
Higher Scoring Group						
Pretest	108	317	38.3	7.514	≤.0001	.52
Post Test	108	340	50.0			

Figure 6 provides a comparison of the increases in mean standard score for the total group, the lower scoring group, and the higher scoring group. All three groups made statistically significant gains. The figure shows that the increase in the mean standard score for the total group was 36 standard score points. The lower scoring group increased 51 standard score points, and the higher scoring group increased 23 standard score points.

Figure 6
Grade 7 *CAMS & STAMS* Lower Scoring Group and Higher Scoring Group
CAMS Pretest and Post Test Comparisons

*Difference statistically significant at ≤.0001

**Difference statistically significant at ≤.005

Conclusions

The study sought to determine the educational efficacy of a program developed to increase students' mathematics skills and strategies. The program, entitled the *Comprehensive Assessment of Mathematics Strategies* and *Strategies to Achieve Mathematics Success* ©2011, is published by Curriculum Associates and is commonly referred to as *CAMS & STAMS*.

Two research questions guided the study:

1. Does the *Comprehensive Assessment of Mathematics Strategies* and *Strategies to Achieve Mathematics Success* ©2011 program improve the mathematics skills and strategies of students at grades 3 and 7?

2. Is the *Comprehensive Assessment of Mathematics Strategies* and *Strategies to Achieve Mathematics Success* ©2011 program equally effective in improving the mathematics skill and strategies of lower-performing students as well as higher-performing students at grades 3 and 7?

Question 1: Does the *Comprehensive Assessment of Mathematics Strategies* and *Strategies to Achieve Mathematics Success* ©2011 improve the mathematics skills and strategies of students at grades 3 and 7?

Pretest and post test comparisons for students on the nationally standardized SAT-9 mathematics assessment and the *CAMS* assessment were analyzed for grade 3 and grade 7 students. A summary of those results is provided in Tables 14 and 15.

Table 14 shows the various comparisons conducted for grade 3. Differences between scores on the SAT-9 and the *CAMS* assessment for the *CAMS & STAMS* treatment group were statistically significant when compared to the scores for the control group. Comparisons of pretest to post test scores also showed statistically significant differences for both the *CAMS & STAMS* treatment group and the control group.

Table 15 shows the various comparisons conducted for grade 7. Similarly, differences between scores on the SAT-9 and the *CAMS* assessment for the *CAMS & STAMS* treatment group were statistically significant when compared to the scores for the control group. Comparisons of pretest to post test scores also showed statistically significant differences for both the *CAMS & STAMS* treatment group and the control group.

Table 14
Summary of Grade 3
Comparisons

	Differences Statistically Significant?	Effect Size of Difference
Grade 3—SAT-9 Assessment		
CAMS & STAMS Treatment Group Post Test to Control Group Post Test	Yes	Small
CAMS & STAMS Treatment Group Pretest to Post Test	Yes	Large
Grade 3—CAMS Assessment		
CAMS & STAMS Treatment Group Pretest to Post Test	Yes	Large
Control Group Pretest to Post Test	Yes	Medium

Table 15
Summary of Grade 7
Comparisons

	Differences Statistically Significant?	Effect Size of Difference
Grade 7—SAT-9 Assessment		
CAMS & STAMS Treatment Group Post Test to Control Group Post Test	Yes	Small
CAMS & STAMS Treatment Group Pretest to Post Test	Yes	Medium
Grade 7—CAMS Assessment		
CAMS & STAMS Treatment Group Pretest to Post Test	Yes	Large
Control Group Pretest to Post Test	Yes	Small

Question 2: Is the *Comprehensive Assessment of Mathematics Strategies* and *Strategies to Achieve Mathematics Success* ©2011 program equally effective in improving the mathematics skill and strategies of lower-performing students as well as higher-performing students at grades 3 and 7?

Pretest and post test comparisons were analyzed for grade 3 and grade 7 lower and higher pretest scoring students, and a summary of those results is provided in Table 16. The results show that the pretest to post test differences were all statistically significant. The effect sizes for all of the statistically significant comparisons were large, with the exception of the grade 7 higher scoring group on the *CAMS* assessment, where the effect size was medium.

Table 16
Summary of Grade 3 and Grade 7
Lower Scoring Group and Higher Scoring Group
Pretest and Post Test Comparisons

	Differences Statistically Significant?	Effect Size of Difference
Grade 3 (Lower Scoring Group)		
SAT-9	Yes	Large
CAMS	Yes	Large
Grade 3 (Higher Scoring Group)		
SAT-9	Yes	Large
CAMS	Yes	Large
Grade 7 (Lower Scoring Group)		
SAT-9	Yes	Large
CAMS	Yes	Large
Grade 7 (Higher Scoring Group)		
SAT-9	Yes	Large
CAMS	Yes	Medium

The conclusion, substantiated by the data presented, is that students using the *Comprehensive Assessment of Mathematics Strategies* and *Strategies to Achieve Mathematics Success* ©2011 program made significant gains from pretesting to post testing.

On the basis of this study, both research questions can be answered positively.

1. The *Comprehensive Assessment of Mathematics Strategies* and *Strategies to Achieve Mathematics Success* ©2011 program does improve the mathematics skills and strategies of students at grades 3 and 7.

2. The *Comprehensive Assessment of Mathematics Strategies* and *Strategies to Achieve Mathematics Success* ©2011 program is effective in improving the mathematics skills and strategies of both lower-performing students and higher-performing students at grades 3 and 7.