

Achieve3000®

Achieve3000 Math™

NEW JERSEY EFFICACY STUDY

An Independent Evaluation of the Effectiveness of **Achieve3000 Math** on Math Skills Growth in New Jersey Classrooms



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Executive Summary

Overview

During the 2014-2015 school year, SEG Measurement conducted a national study of the effectiveness of Achieve3000 Math, an online system that provides individualized adaptive feedback and breaks down problems into smaller concepts to help students learn critical math skills. As part of that study, SEG evaluated the growth in mathematics knowledge and skills within participating New Jersey (NJ) classrooms.

Seven hundred ninety-two (792) students and 13 teachers in sixth- and seventh-grade NJ classrooms participated in the study. The results indicate that students in New Jersey using Achieve3000 Math showed significantly greater improvement in mathematics skills than students in New Jersey classrooms that did not use Achieve3000 Math. Sixth-grade Achieve3000 Math users showed 53% more growth than is typically seen and seventh-grade Achieve3000 Math users showed 57% more growth than typically seen.

Study Design

The study employed a quasi-experimental design, comparing the growth in mathematics skills between two groups of students, students who used Achieve3000 Math as part of their mathematics instruction (treatment group) and comparable students who did not use Achieve3000 Math as part of their mathematical instruction (control group). The growth in mathematics skills was assessed using curriculum-aligned pre-tests administered at the beginning of the study and curriculum-aligned post-tests administered at the end of the study.

The mathematics knowledge and skills growth in the treatment group and the control group was compared statistically using Analysis of Covariance (ANCOVA). ANCOVA provides a comparison between the treatment and control group students, while adjusting for any potential differences in students' initial ability. Specifically, we examined the difference in the post-test scores (dependent variable) between the treatment and control groups (independent variable) controlling for the initial ability of the students from the pre-test (covariate).

“Students in New Jersey classrooms using Achieve3000 Math showed significantly greater improvement in mathematics skills than comparable students in New Jersey classrooms that did not use Achieve3000 Math.”

“Sixth-graders using Achieve3000 Math showed 53% more growth than is typically seen, and seventh-grade students showed 57% more growth than is typically seen on national assessments.”

Study Results

The analysis indicated that students in New Jersey classrooms that used Achieve3000 Math showed significantly more growth in math skills than New Jersey classrooms that did not use Achieve3000 Math. Sixth-grade New Jersey students using Achieve3000 Math showed about 24 points more growth on the assessment, or .21 standard deviations, than did sixth-graders not using Achieve3000 Math (Effect Size=.21; F=4.42; P=.04). Seventh-graders showed about 28 points more growth on the assessment, or .17 standard deviations, than did nonusers (Effect Size=.17; F=4.96; P=.03). For a student in sixth grade at the 50th percentile, this represents a gain to the 58th percentile. For a student in the seventh-grade at the 50th percentile, this represents a gain to the 57th percentile.

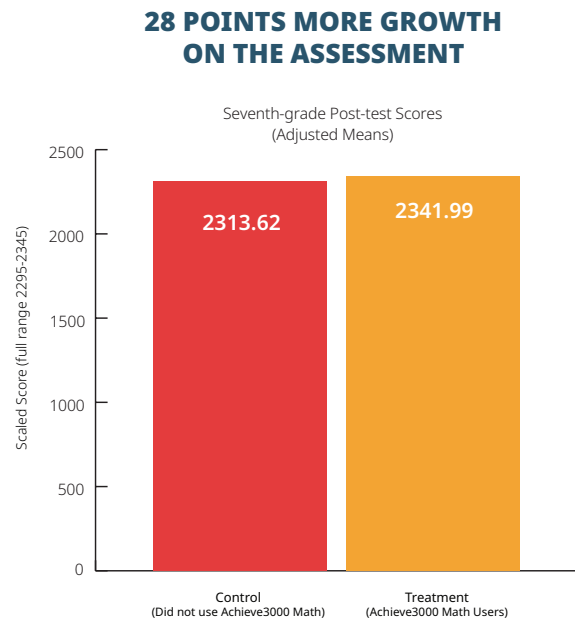
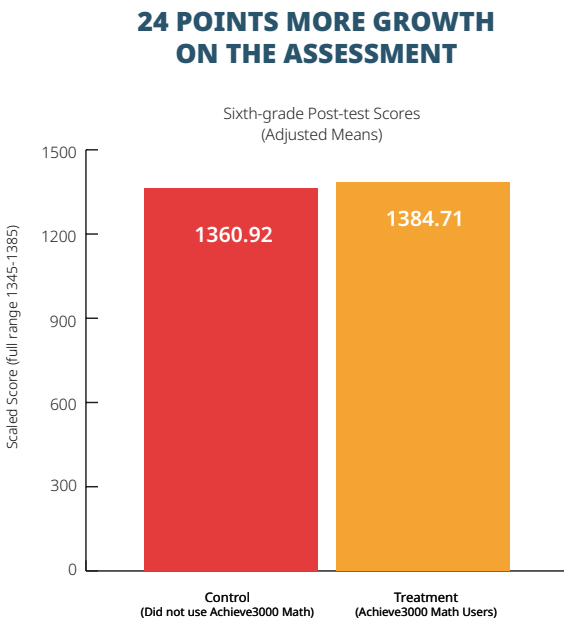
The average (mean) mathematics test scores for the treatment and control group students are shown in Figures 1 and 2.

“Sixth-grade New Jersey students using Achieve3000 Math showed about 24 points more growth on the assessment, or .21 standard deviations, than did sixth-graders not using Achieve3000 Math . Seventh-graders showed about 28 points more growth on the assessment, or .17 standard deviations, than did nonusers.”

“The results support the effectiveness of Achieve3000 Math use in improving sixth- and seventh-grade students’ math skills...”

Figure 1: Comparison of Sixth-grade Post-test Scores for Treatment and Control Groups (Adjusted Means)

Figure 2: Comparison of Seventh-grade Post-test Scores for Treatment and Control Groups (Adjusted Means)



THE RESULTS SUPPORT THE EFFECTIVENESS OF **ACHIEVE3000 MATH USE IN IMPROVING SIXTH- AND SEVENTH-GRADE STUDENTS’ MATH SKILLS.**

Introduction

This study examines the impact of Achieve3000 Math on New Jersey sixth- and seventh-grade student math skills. Achieve3000 Math is an online math product that provides one-on-one individualized and adaptive math tutoring on specific skills and concepts.

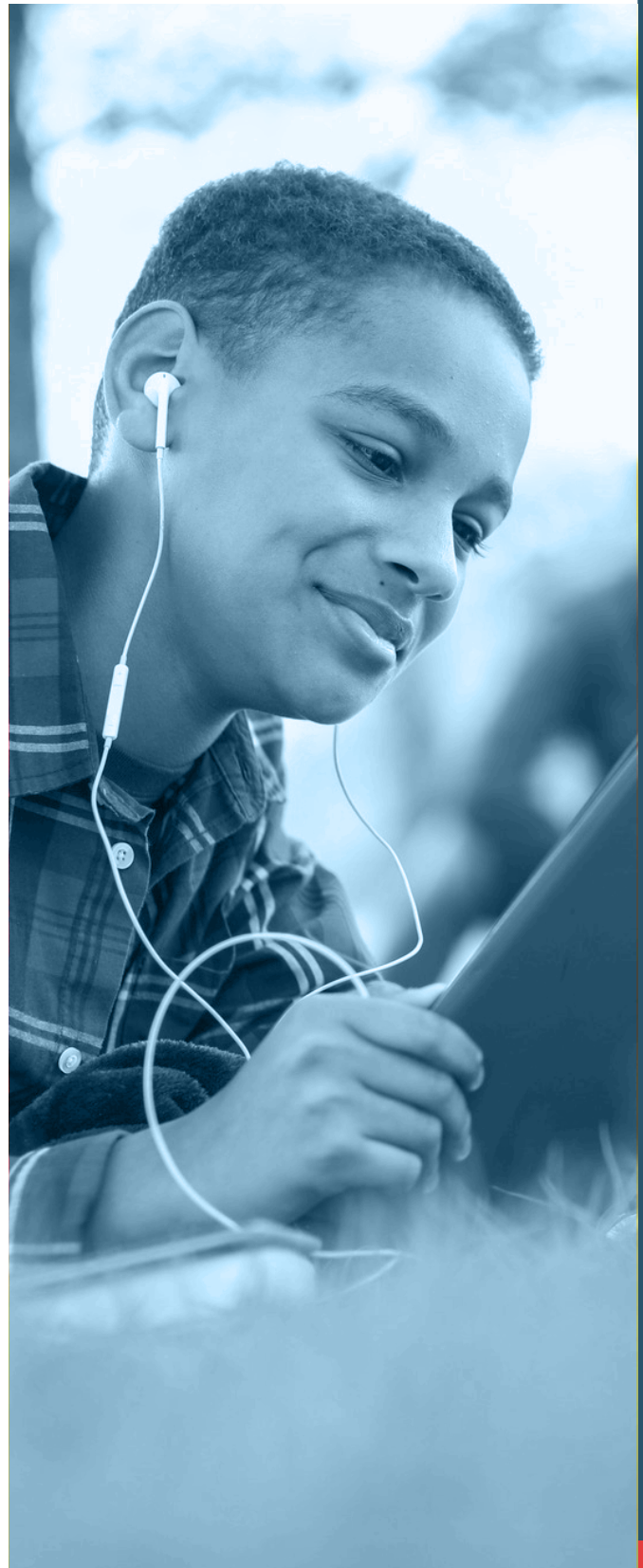
The study investigated the use of Achieve3000 Math between January and June 2015 in 6th- and 7th-grade classes in two districts in New Jersey. Student learning in mathematics in classes using Achieve3000 Math (treatment group) was compared to student learning in mathematics in classes that did not use Achieve3000 Math (control group). Sixth- and seventh-grade pre- and post-standardized and curriculum-aligned assessments of mathematics skills were used as the independent measures of students' mathematics skills.

This report provides the details regarding the quantitative results from NJ schools conducted in conjunction with the broader national study which is reported separately.

About Achieve3000 Math

Achieve3000 Math uses dynamic math problems to help teach students standards aligned math concepts. Unlike most math problems, which start and end with one question, Achieve3000 Math problems respond in real-time to student input. If a student asks for help or answers a question incorrectly, the initial problem is broken down into smaller, more manageable steps. Every step is connected to a standard aligned concept, allowing the teacher to see exactly which prerequisite concepts the student is missing.

Achieve3000 Math tracks every student's progress toward mastery as they learn. Mastery is the probability the student truly understands the concept. With the Achieve3000 Math dashboard, teachers have easy and quick access to critical data and powerful tools to inform instruction and guide learning. Achieve3000 Math enables teachers to see a holistic picture of their students' progress within and across grades while identifying mastery levels of standard aligned math concepts.



Study Findings

Research Questions

The primary research questions addressed by this study focused on the effectiveness of Achieve3000 Math.

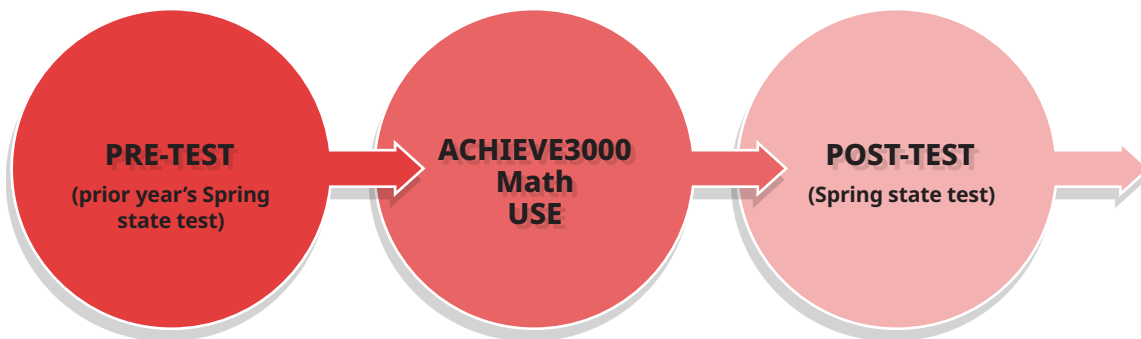
- ✓ Do students who use Achieve3000 Math show larger gains in mathematics skills than comparable students who do not use Achieve3000 Math?
- ✓ Are there any differences in performance based on the outcome measure (i.e., the broad national assessment or the more targeted assessment)?

Study Design

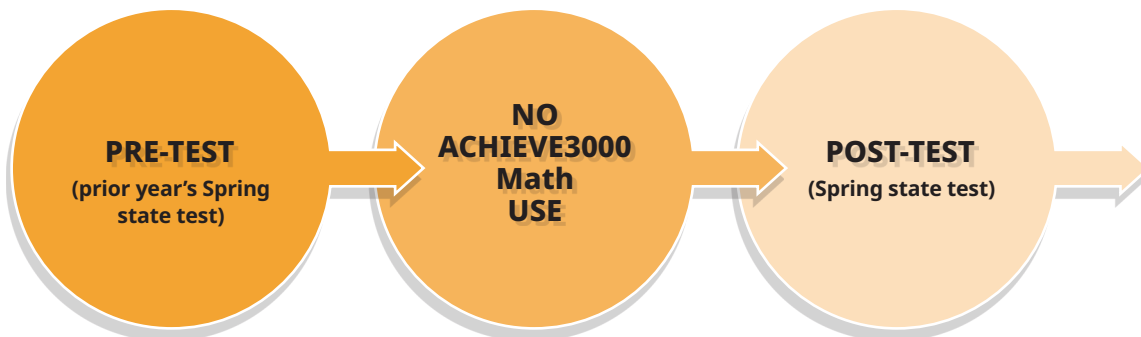
The study employed a treatment-control group comparison design. Since the students were not randomly assigned to the groups, this is considered a quasi-experimental design. The treatment group classes used Achieve3000 Math, while the control group classes used traditional mathematics instruction without the use of Achieve3000 Math. The study design is depicted in Figure 3.

Figure 3: Study Design

Treatment Group



Control Group



Data Collection

In January 2015, SEG Measurement conducted the pre-test. Teachers in the treatment and control group classes were provided with the pre-tests, answer sheets, and instructions for administration. Teachers were asked to administer the pre-tests during a class period as soon as possible and to encourage the students to do their best. The teachers were provided with instructions and materials to return the tests to SEG Measurement for processing. SEG Measurement entered and validated the student assessment data collected from the pre-test.

At the end of the school year, SEG conducted the post-test. A similar process was followed for the administration of the post-tests to all classes participating in the study. SEG Measurement entered and validated the student post-test assessment data and merged this data with the pre-test data for use in the evaluation.

Teachers were surveyed, online, in May 2015. This data was exported and integrated with the student data.

Data Management

For both the pre- and post-test administrations, the responses from the multiple choice answer sheets were entered into a database and scored. Any questions that the students did not answer were scored as incorrect. Students answering fewer than half of the items on the assessment were removed from the analysis. Any student responses that appeared to be suspect (e.g., selecting the same answer for every item) were flagged as non-attempts and were removed from the final analysis. All data was reviewed and checked for accuracy.

Fidelity Monitoring

Fidelity Monitoring, confirming that the treatment (Achieve3000 Math use) was implemented as prescribed, is a critical component of the research. To that end, the Achieve3000 Math online system was used to track the number of logins for each class, the amount of time spent using Achieve3000 Math, the number of concepts mastered, and teacher logins. Average weekly usage in this treatment district ranged from 26 minutes to 96 minutes, with the mean weekly usage being about 49 minutes. Classes logged into Achieve3000 Math an average of 16 weeks during the study.

Participants

Students in classes that did not use Achieve3000 Math composed the Control Group. Students in classes that used Achieve3000 Math a minimum of 40 minutes on average per week composed the Treatment Group. Students in classes that did not use Achieve3000 Math at least 40 minutes were removed from the analyses.

This supplemental study, complementing the broader national study, focuses on Achieve3000 Math use in New Jersey schools. Thirteen teachers (9 treatment and 4 control) participated with one or more 6th- or 7th-grade classes. Seven hundred ninety-two students were represented in these classes. The treatment group contained 487 students and the control group contained 305 students. The profile summaries of the students and teachers are provided in Tables 1 and 2.

Table 1: Profile of Participating Students

	Grade 6		Grade 7	
	Treatment	Control	Treatment	Control
Gender				
Female	54%	55%	48%	25%
Male	46	45	52	22
Not Reported	0	0	<1	53
Ethnicity				
African American	3	2	2	0
Asian or Pacific Islander	6	2	6	4
Caucasian	75	64	65	37
Hispanic	6	4	7	3
Mixed Race or Other	10	11	11	4
Not Reported	<1	17	9	53

Table 2: Profile of Participating Teachers

	Grade 6	
	Treatment	Control
Gender		
Female	92%	100%
Male	8	0
Ethnicity		
Caucasian	100	75
Hispanic	0	25
Teaching Experience		
This is my first year	0	0
2 – 4 years	8	0
5 – 9 years	0	75
10 – 14 years	23	0
15 – 24 years	23	25
25 or more years	15	0
Highest Degree		
Bachelor's	44	50
Master's	56	50

Description of the Outcome Measure

National standardized tests of 6th- and 7th-grade math skills were used as the pre-test. In addition to the national test, the post-test administered at NJ sites included an additional curriculum-aligned measure of skills taught. The post-test contained a combined total of 42 items.

Description of the Treatment

Achieve3000 Math uses dynamic math problems to help teach students standards-aligned math concepts. Unlike most math problems, which start and end with one question, Achieve3000 Math problems are dynamic responding in real-time to student input. If a student asks for help or answers a question incorrectly, the initial problem is broken down into smaller, more manageable steps. Every step is connected to a standard-aligned concept, allowing the teacher to see exactly which prerequisite concepts the student is missing.

The units covered within Achieve3000 Math for grades 6 and 7 include Expressions and Equations, Geometry, Ratios and Proportional Relationships, Statistics and Probability, and Number System. The treatment group classes in this study used Achieve3000 Math at least 40 minutes on average each week. The control group did not have access to Achieve3000 Math.

Initial Comparability of the Groups

It is very important in a study comparing student academic outcomes to establish at the outset that the treatment group and control group were similar with respect to student academic ability, the outcome of interest. Demonstrating baseline equivalence of the treatment and control groups minimizes potential bias from selection in quasi-experimental designs that can alter effect size estimates. If the treatment group and the control group are not similar, we cannot be sure if the growth we see is due to the treatment (in this case, use of Achieve3000 Math) or the result of some differences in the individuals that existed before we conducted the study.

Pre-test score performance was used to compare the initial ability levels for students in the treatment and control groups. The sixth-grade treatment and control groups were found to have modest differences in initial ability while there were no statistically significant differences found in the initial ability of the seventh-grade student (Grade 6: $F = 8.62$, $p < .01$, Grade 7: $F=2.71$, $p=.10$). The initial ability level of the Grade 6 control group was somewhat higher than the Grade 6 treatment group. This difference is roughly .33 standard deviations. These differences in initial comparability are within recommended limits and can be further controlled for through the use of ANCOVA.

Analysis and Findings

The mathematics knowledge and skills of NJ students using Achieve3000 Math (treatment group) was compared to the mathematics knowledge and skills of NJ students who did not use Achieve3000 Math (control group).

Using Multivariate Analysis of Covariance (MANCOVA), we examined the difference in the composite post-test scores (dependent variables) between the treatment and control groups (independent variable) controlling for the initial proficiency of the students (covariate). The pre-test score was used as the covariate to place students in the treatment group and the control group on the same baseline. These analyses were run separately for each grade.

Grade 6 Math Skills Results

The results show an effect size of .21 for the targeted assessment. While the Treatment students performed higher on the national assessment, the results between the groups were statistically comparable. Sixth-grade students who used Achieve3000 Math achieved significantly higher scores on the targeted assessment of math skills used in the study than students who did not use Achieve3000 Math ($F = 4.42, p = .036$). Achieve3000 Math users (treatment) scored .21 standard deviations higher than non users on the targeted assessment covering Ratio and Proportions and Number Systems. For a student at the 50th percentile, an effect size of .21 would produce a gain to the 58th percentile. The results are summarized in Tables 3, 4, and 5 below.

The overall MANCOVA showed that the composite post-test performance of the 6th grade students in the Treatment and Control groups were comparable ($F=2.222, p=.11$) as shown in Table 3.

Table 3: Analysis of Covariance of the Treatment and Control Group 6th-Grade Post-test Scores

Source	Value	F	Hypothesis df	Error df	Significance
Intercept	.150	26.472	2.000	299.000	<.01
Pre-test	.557	188.091	2.000	299.000	<.01
Study Group	.015	2.222	2.000	299.000	.110

When investigating the differences between Treatment and Control group students in the sixth grade, we see that the Treatment students performed higher than the Control students. The primary contribution was from the curriculum-aligned assessment. The differences on the curriculum-aligned assessment were statistically significant. Sixth-graders who used Achieve3000 Math showed higher scores than comparable students who did not use Achieve3000 Math ($F=4.42, p=.036$).

Table 4: Tests of Between Subject Effects for 6th-Grade Post-test Scores

Source	Measure	Type III Sum of Squares	df	Mean Square	F	Significance
Corrected Model	Broad Post-test	242214.263	2	121107.131	172.860	<.01
	Targeted Post-test	1420554.712	2	710277.356	81.377	<.01
Intercept	Broad Post-test	35988.041	1	35988.041	51.367	<.01
	Targeted Post-test	22148.183	1	22148.183	2.538	.112
Pre-test	Broad Post-test	239316.834	1	239316.834	341.585	<.01
	Targeted Post-test	1420550.095	1	1420550.095	162.753	<.01
Study Group	Broad Post-test	709.863	1	709.863	1.013	.315
	Targeted Post-test	38581.645	1	38581.645	4.420	.036
Error	Broad Post-test	210182.219	300	700.607		
	Targeted Post-test	2618471.690	300	8728.239		
Total	Broad Post-test	147281953.000	303			
	Targeted Post-test	577792500.000	303			
Corrected Total	Broad Post-test	452396.482	302			
	Targeted Post-test	4039026.403	302			

Table 5: Descriptive Statistics Comparison of the Treatment and Control Group 6th-Grade Post-test Scores (Adjusted for Pre-test Performance)

Measure	Group	Number of Students	Post-test Scores	
			Mean	Standard Deviation
Broad Assessment	Treatment	193	697.29	41.66
	Control	110	694.07	32.67
Targeted Assessment	Treatment	193	1384.71	115.59
	Control	110	1360.92	116.27

Grade 7 Math Skills Results

The results show an effect size of .17 for the targeted assessment. The treatment students performed higher on the national assessment. Seventh-grade students who used Achieve3000 Math achieved significantly higher scores on the curriculum-aligned assessment of math skills used in the study than students who did not use Achieve3000 Math ($F = 4.956$, $p = .027$). Achieve3000 Math users (treatment) scored .17 standard deviations higher than non users on the targeted, curriculum-aligned assessment. For a student at the 50th percentile, an effect size of .17 would produce a gain to the 57th percentile. The results are summarized in Tables 6, 7, and 8 below.

Table 6: Multivariate Analysis of Covariance Comparison of the Treatment Group and Control Group 7th-Grade Post-test Scores and Grades (using Pillai's Trace)

Source	Value	F	Hypothesis df	Error df	Significance
Intercept	.185	47.677	2.000	419.000	<.01
Pre-test	.565	272.267	2.000	419.000	<.01
Study Group	.012	2.621	2.000	419.000	.074

When investigating the differences between Treatment and Control group students in the seventh-grade, we see that the Treatment students performed higher than the Control students. The curriculum-aligned assessment was the primary contributor to the differences observed. The differences on the curriculum-aligned assessment were statistically significant. Seventh-graders who used Achieve3000 Math showed higher scores on this assessment than comparable students who did not use Achieve3000 Math ($F=4.956$, $p=.027$).

Table 7: Tests of Between Subject Effects for 7th-Grade Post-test Scores

Source	Measure	Type III Sum of Squares	df	Mean Square	F	Significance
Corrected Model	Broad Post-test	327604.652	2	163802.326	231.040	<.01
	Targeted Post-test	4583360.526	2	2291680.263	145.691	<.01
Intercept	Broad Post-test	8342.790	1	8342.790	11.767	.001
	Targeted Post-test	769543.680	1	769543.680	48.923	<.01
Pre-test	Broad Post-test	327557.215	1	327557.215	462.012	<.01
	Targeted Post-test	4570176.088	1	4570176.088	290.544	<.01
Study Group	Broad Post-test	1386.326	1	1386.326	1.955	.163
	Targeted Post-test	77957.889	1	77957.889	4.956	.027
Error	Broad Post-test	297771.437	420	708.980		
	Targeted Post-test	6606473.990	420	15729.700		
Total	Broad Post-test	208417905.000	423			
	Targeted Post-test	761457500.000	423			
Corrected Total	Broad Post-test	625376.090	422			
	Targeted Post-test	11189834.515	422			

Table 8: Descriptive Statistics Comparison of the Treatment and Control Group 7th-Grade Post-test Scores (Adjusted for Pre-test Performance)

Measure	Group	Number of Students	Post-test Scores	
			Mean	Standard Deviation
Broad Assessment	Treatment	271	702.24	40.07
	Control	152	698.46	35.65
Targeted Assessment	Treatment	271	2341.99	152.47
	Control	152	2313.62	180.14

Conclusion

A quasi-experimental, treatment/control, pre/post study of the impact of Achieve3000 Math use in New Jersey classrooms conducted during the 2014-2015 school year as part of a national study of Achieve3000 Math efficacy supports the effectiveness of Achieve3000 Math use in improving student math skills.

Sixth- and seventh-grade students who used Achieve3000 Math showed significantly more growth in mathematics skills than students who did not use Achieve3000 Math (Effect size for 6th grade=.21, Effect size for 7th grade=.17). These results were found with Achieve3000 Math usage of at least 40 minutes on average each week.

The .21 Effect Size found in sixth-grade and .17 Effect Size observed in seventh compare favorably with recent research comparing the effects of educational technology applications and traditional methods. Cheung and Slavin (2013) report an overall (mean) Effect Size of .15, based on a review of 84 studies examining the effects of educational technology applications on mathematics achievement in K-12 classrooms.

One important basis for evaluating these study results is to consider the additional contribution of Achieve3000 Math use to the typical mathematics growth expected in the grade levels studied. The average mathematics achievement gain (expressed as an effect size) for students in sixth-grade on nationally normed tests is .40, and .30 for seventh-graders (Lipsey, et al, 2012). While it is difficult to make definitive comparisons between this localized assessment and national standardized assessments, we can use the results as a proxy for typical achievement at these grade levels. On that basis, this means that New Jersey Achieve3000 Math users in sixth-grade showed 53% more growth in mathematics than is typically expected (.21/.40). Seventh-grade New Jersey Achieve3000 Math users showed 57% more growth in mathematics than is typically expected (.17/.30).

The results support the effectiveness of Achieve3000 Math use in improving sixth- and seventh-grade students' math skills in New Jersey.

**This study was completed for a math product called LearnBop, which Achieve3000 acquired and updated as Achieve3000 Math. SEG Measurement verified that its findings concerning the efficacy of LearnBop apply to Achieve3000 Math.*

References

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Lipsey, M. W., Puzio, K., Yun, C., Hebert, M. A., Steinka-Fry, K., Cole, M. W., Roberts, M., Anthony, K. S., & Busick, M. D. (2012). Translating the statistical representation of the effects of education interventions into more readily interpretable forms. ERIC.

To learn more about Achieve3000 Math, please contact **1-800-838-8771** or visit **achieve3000.com**.

About Achieve3000

Achieve3000 delivers a comprehensive suite of digital solutions that significantly accelerate literacy and deepen learning across the content areas. Using personalized and differentiated solutions, Achieve3000 provides equity for remote and on-site instruction, enabling educators to help all students achieve accelerated growth. For more than four million students in grades PreK-12, Achieve3000 improves high-stakes test performance and drives college and career readiness.