Achieve3000®

Achieve3000 Math™

NATIONAL **EFFICACY STUDY**

An Independent Evaluation of the Effectiveness of Achieve3000 Math Use on Students' Math Skills

SEGMEASUREMENT

BUILDING BETTER ASSESSMENTS / EVALUATING PRODUCT EFFECTIVENESS

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Overview

During the 2014-2015 school year, SEG Measurement conducted a 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.

Eight hundred and twenty-eight (828) students and 20 teachers, in sixth- and seventh-grade classrooms in three states participated in the study. Students in classrooms using Achieve3000 Math showed significantly greater improvement in mathematics skills than comparable students in classrooms that did not use Achieve3000 Math. Achieve3000 Math users in sixth-grade showed 40% more growth than expected and seventh-grade Achieve3000 Math users showed 66% more growth than expected. Teachers reported that the Achieve3000 Math application is an effective tool for delivering mathematics instruction and both teachers and students were observed to use the application as prescribed.

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

Study Design

The study employed a mixed-methods approach including a quasi-experimental study of Achieve3000 Math users and nonusers, teacher surveys, and classroom observation of teachers and students. We conducted a quasi-experimental study 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 The Stanford 10, with pre-tests administered at the beginning of the study and post-tests administered at the end of the study.

"Achieve3000 Math users in sixth-grade showed 40% more growth in mathematics than expected and seventh-grade Achieve3000 Math users showed 66% more growth in mathematics than expected."

We obtained additional evidence of effectiveness from participating teachers and students. Teachers were surveyed to assess their perceptions of Achieve3000 Math and its effectiveness. Teachers and students were observed in classroom settings to further evaluate Achieve3000 Math effectiveness.

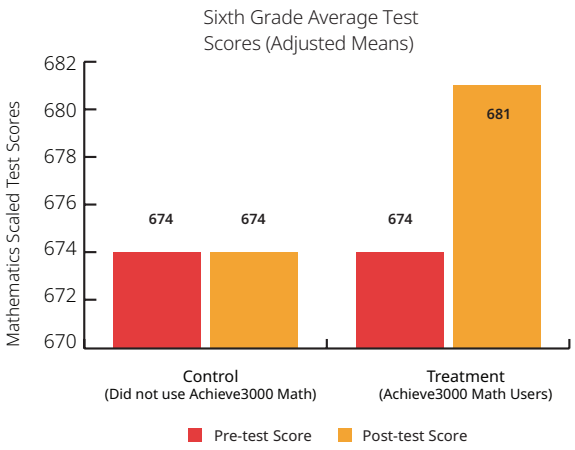
The mathematics knowledge and skills growth in the treatment group and the control group was compared statistically using Analysis of Covariance (ANCOVA). Treatment and control group (independent variable) mathematics assessment scores (dependent variable) were compared, while adjusting for any potential differences in students' initial ability on a mathematics pre-test (covariate).

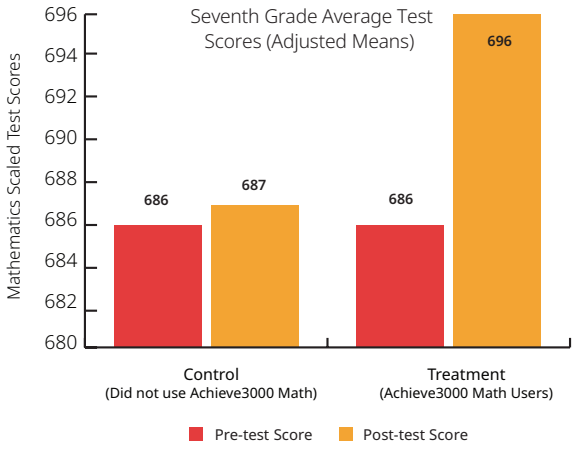
Study Results

The analysis indicated that students who used Achieve3000 Math showed significantly more growth in mathematics skills than comparable students who did not use Achieve3000 Math. Sixth-grade students using Achieve3000 Math showed about 7 points more growth on the assessment than did sixth-graders not using Achieve3000 Math (Effect Size=.16; F=5.14; p=.02). Seventh-graders using Achieve3000 Math showed about 9 points more growth than did seventh-graders not using Achieve3000 Math (Effect Size=.20; F = 10.87, p < .01).

"Sixth-grade students using Achieve3000 Math showed about 7 points more growth on the assessment than did sixth-graders not using Achieve3000 Math…Seventh-grade students using Achieve3000 Math showed about 9 points more growth on the assessment than did nonusers …"

Figure 1: Comparison of Mean Post-test Scores for Treatment and Control Groups Post-test After 16 Weeks





Teachers in the treatment group were surveyed to gather information about Achieve3000 Math usage and its effectiveness.

About three-quarters of the teachers indicated that Achieve3000 Math was well aligned to their math instructional goals (77%) and that it was easy to determine who needed intervention with Achieve3000 Math (73%). More than four-fifths indicated that Achieve3000 Math was well aligned to Common Core State Standards (83%) and that it was easy for them to create classes and assignments in Achieve3000 Math (86%).

The observations of teachers and students in the classroom showed that, as a whole, teachers and students found Achieve3000 Math easy to use and fun and helpful. The observations also confirmed that Achieve3000 Math was being implemented as prescribed.

Conclusion

Together, the quantitative and qualitative results support the effectiveness of Achieve3000 Math use in improving sixth and seventh-grade students' math skills. Achieve3000 Math users in sixth-grade showed 40% more growth in mathematics than is typically seen between fifth- and sixth-grade (normative effect=.41; Lipper, et al, 2012). Seventh-grade Achieve3000 Math users showed 66% more growth in mathematics than is typically seen between sixth- and seventh-grade (normative effect =.30; Lipper, et al, 2012). The effect sizes found in this study compare favorably with recent research comparing the effects of educational technology applications with traditional methods (Cheung and Slavin, 2013).

"Together, the quantitative and qualitative results support for the effectiveness of Achieve3000 Math use in improving sixth- and seventh-grade students' math skills...."

"Achieve3000 Math users in sixth-grade showed 40% more growth in mathematics than is typically seen between fifth- and sixth-grade. Seventh-grade Achieve3000 Math users showed 66% more growth in mathematics than is typically seen between sixth- and seventh-grade."

Introduction

This study examines the impact of Achieve3000 Math use on 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. Quantitative and qualitative methods were used to investigate the effectiveness of Achieve3000 Math.

The study investigated the use of Achieve3000 Math between January and June 2015 in sixth- and seventh-grade classes. 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 assessments of mathematics skills were used as the independent measures of students' mathematics skills.

Participating teachers provided feedback regarding Achieve3000 Math and ratings of effectiveness. Teachers and students were observed using Achieve3000 Math in the classroom. This report describes the design, conduct and results from the study.

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 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.

Achieve3000 Math tracks each 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 grade 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?
- ✓ Do teachers perceive Achieve3000 Math to be effective?
- ✓ Do teachers and students use Achieve3000 Math effectively in the classroom?

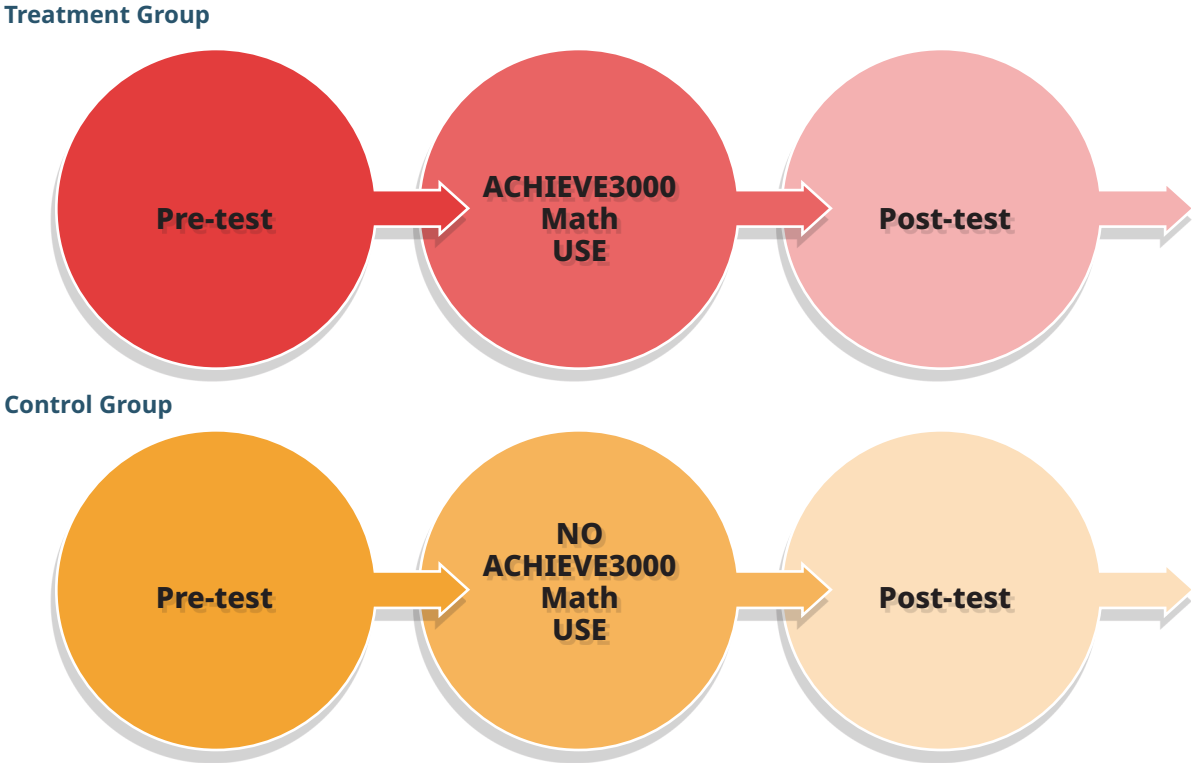
The secondary research questions addressed the effectiveness of Achieve3000 Math within student subgroups.

- ✓ Are there differences in the effectiveness of Achieve3000 Math between males and females?
- ✓ Are there differences in the effectiveness of Achieve3000 Math among different ethnic groups?

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 2.

Figure 2: Study Design



Data Collection

Student math skills were measured using the Stanford 10 standardized measure of mathematics skills.
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 Measurement 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 ranged from 26 minutes to over 120 minutes, with the mean weekly usage being about 51 minutes. Classes logged into Achieve3000 Math an average of 16 weeks during the study.

Participants

The control group consisted of students in classes that did not use Achieve3000 Math. Students in classes that used Achieve3000 Math a minimum of 60 minutes on average per week composed the Treatment Group. Students in classes that did not use Achieve3000 Math at least 60 minutes were removed from the analyses.

Seven schools in 5 districts in 3 states participated in the study. Within those schools, 20 teachers (7 treatment, and 13 control) participated with one or more sixth- or seventh-grade classes. Eight hundred twenty-eight (828) students were represented in these classes. The treatment group contained 353 students and the control group contained 475 students. The students in the treatment and control groups were similar in background characteristics. The teachers were similar, however teachers in the control group were more likely to be male and have more experience. 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	53%	52%	49%	33%
Male	47	48	50	36
Not Reported	0	0	<1	31
Ethnicity				
African American	4	6	5	14
Asian or Pacific Islander	1	1	<1	2
Caucasian	87	69	65	38
Hispanic	2	5	8	5
Mixed Race or Other	6	13	10	8
Not Reported	0	6	11	33

Table 2: Profile of Participating Teachers

	Grade 6		Grade 7	
	Treatment (N=3)	Control (N=8)	Treatment (N=4)	Control (N=5)
Gender				
Female	100%	50%	75%	60%
Male	0	50	25	40
Ethnicity				
African American	25	0	0	20
Asian or Pacific Islander	0	0	0	0
Caucasian	75	66	100	40
Hispanic	0	0	0	40
Mixed Race or Other	0	0	0	0
Not Reported	0	33	0	0
Teaching Experience				
This is my first year	0	12.5	20	0
2 – 4 years	67	25	20	25
5 – 9 years	0	25	40	0
10 – 14 years	0	12.5	0	50
15 or more years	0	25	20	25
Not Reported	33	0	0	0
Highest Degree				
Bachelor's	0	38	25	40
Master's	66	62	75	60
Not Reported	33	0	0	0

Description of the Outcome Measure

National standardized tests of sixth- and seventh-grade math skills were used as pre- and post-tests. The tests included 30 multiple-choice items covering the range of mathematics content typically taught at the sixth- and seventh-grade levels. The tests were designed to be completed within one class period. The raw test scores are scaled on a vertical scale to allow a common interpretation across grade levels.

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 used Achieve3000 Math at least 60 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 treatment and control groups were found to have modest differences in initial ability (Grade 6: $F=27.02$, $p<.01$, Grade 7: $F=4.737$, $p=.03$) , within accepted statistical guidelines. The initial ability level of the Grade 6 control group was somewhat higher than the Grade 6 treatment group. This difference is roughly .55 standard deviations. The initial ability of the Grade 7 treatment group was slightly higher than the Grade 7 control group. This difference is roughly .20 standard deviations. These differences in initial comparability are controlled for through the use of Analysis of Covariance.

Analysis and Findings

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

Using Analysis of Covariance (ANCOVA), we examined the difference in the post-test score (dependent variable) 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

Sixth-grade students who used Achieve3000 Math achieved significantly higher scores on the assessment of math skills used in the study than students who did not use Achieve3000 Math (F =5.14, p=.02). Achieve3000 Math users (treatment) scored .16 standard deviations higher than non users on the assessment (Effect Size=.16; Cohen's D). For a student at the 50th percentile, an effect size of .16 would produce a gain to the 56th percentile. The results are summarized in Tables 3 and 4 below.

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

Source	Type III Sum of Squares	df	Mean Square	F	Significance
Corrected Model	475454.193	2	237727.096	314.449	<.01
Intercept	21869.831	1	21869.831	28.928	<.01
Pre-test	459808.502	1	459808.502	608.203	<.01
Study Group	3886.513	1	3886.513	5.141	.024
Error	266871.987	353	756.011		
Total	163793734.000	356			
Corrected Total	742326.180	355			

Table 4: Descriptive Statistics Comparison of the Treatment and Control Group 6th Grade Post-test Scores (Adjusted for Pre-test Performance)

Group	Number of Students	Post-test Scores	
		Mean	Standard Deviation
Treatment	125	681.43	46.4
Control	231	674.24	44.7

Sixth-grade Gender Results

We examined whether there were any differential effects for male or female students in the 6th grade. To accomplish this, we conducted analysis of covariance (ANCOVA) similar to the overall analysis, but including gender in the model. As in the overall analysis, we used the pre-test score as the covariate so that the post-test scores could be fairly compared.

There were no significant effects for the interaction between gender and study group membership (F = 3.199, p= .08). This suggests that Achieve3000 Math was equally effective for male and female sixth-grade students. The results are provided in Tables 5 and 6.

Table 5: Analysis of Covariance of the Treatment and Control Group 6th-Grade Post-test Scores by Student Gender

Source	Type III Sum of Squares	df	Mean Square	F	Significance
Corrected Model	478209.877	4	119552.469	158.880	<.01
Intercept	22826.837	1	22826.837	30.336	<.01
Pre-test	452914.252	1	452914.252	601.905	<.01
Study Group	4041.875	1	4041.875	5.371	.021
Gender	10.277	1	10.277	.014	.907
Study Group * Gender	2406.781	1	2406.781	3.199	.075
Error	264116.302	351	752.468		
Total	163793734.000	356			
Corrected Total	742326.180	355			

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

Group	Number of Students	Post-test Scores	
		Mean	Standard Deviation
Treatment			
Female	66	678.9	44.4
Male	59	684.1	48.3
Control			
Female	120	677.1	42.2
Male	111	671.2	46.9

Sixth-grade Ethnicity Results

We also examined whether there were any differential effects among students of different ethnicities. To accomplish this, we conducted analysis of covariance (ANCOVA) similar to the overall analysis, but including ethnicity in the model. As in the overall analysis, we used the pre-test score as the covariate so that the post-test scores could be more fairly compared.

There was no significant effect for the interaction between ethnicity and study group membership (F=0.379, p=.82). This suggests that Achieve3000 Math is equally effective for sixth-graders of varying ethnicities. The results are provided in Tables 7 and 8.

Table 7: Analysis of Covariance of the Treatment and Control Group 6th-Grade Post-test Scores by Student Ethnicity

Source	Type III Sum of Squares	df	Mean Square	F	Significance
Corrected Model	480862.629	11	43714.784	57.514	.000
Intercept	18452.550	1	18452.550	24.277	.000
Pre-test	389926.182	1	389926.182	513.015	.000
Study Group	662.035	1	662.035	.871	.351
Ethnicity	3235.396	5	647.079	.851	.514
Study Group * Ethnicity	1153.279	4	288.320	.379	.823
Error	261463.550	344	760.068		
Total	163793734.000	356			
Corrected Total	742326.180	355			

Table 8: Descriptive Statistics Comparison of the Treatment and Control Group 6th-Grade Post-test Scores (Adjusted for Pre-test Performance) by Student Ethnicity

Group	Number of Students	Post-test Scores	
		Mean	Standard Deviation
Treatment			
African American	5	667.0	50.8
Asian or Pacific Islander	1	684.6	N/A
Caucasian	109	682.5	46.9
Hispanic	2	670.6	28.9
Mixed Race or Other	8	674.8	43.6
Control			
African American	14	662.4	42.6
Asian or Pacific Islander	3	651.0	15.6
Caucasian	159	675.3	40.6
Hispanic	11	677.6	26.0
Mixed Race or Other	30	675.0	50.9
Not Reported	14	675.3	42.4

Grade 7 Math Skills Results

Seventh-grade students who used Achieve3000 Math achieved significantly higher scores on the assessment of math skills used in the study than students who did not use Achieve3000 Math (F =10.87, p<.01). Achieve3000 Math users (treatment) scored .20 standard deviations higher than non users on the assessment (Effect Size=.20; Cohen's D). For a student at the 50th percentile, an effect size of .20 would produce a gain to the 58th percentile. The results are summarized in Tables 9 and 10 below.

Table 9: Analysis of Covariance of the Treatment and Control Group 7th-Grade Post-test Scores

Source	Type III Sum of Squares	df	Mean Square	F	Significance
Corrected Model	471352.665	2	235676.333	302.654	<.01
Intercept	10806.515	1	10806.515	13.878	<.01
Pre-test	445909.649	1	445909.649	572.635	<.01
Study Group	8465.228	1	8465.228	10.871	<.01
Error	365209.598	469	778.699		
Total	226591954.000	472			
Corrected Total	836562.263	471			

Table 10: Descriptive Statistics Comparison of the Treatment and Control Group 7th-Grade Post-test Scores (Adjusted for Pre-test Performance)

Group	Number of Students	Post-test Scores	
		Mean	Standard Deviation
Treatment	228	696.0	40.1
Control	244	687.5	42.9

Seventh-grade Gender Results

We examined whether there were any differential effects for male or female students in the 7th-grade. To accomplish this, we conducted analysis of covariance (ANCOVA) similar to the overall analysis, but including gender in the model. As in the overall analysis, we used the pre-test score as the covariate so that the post-test scores could be more fairly compared.

There were no significant effects for the interaction between gender and study group membership (F=0.756, p=.47). This suggests that Achieve3000 Math was equally effective for male and female 7th-grade students. The results are provided in Tables 11 and 12.

Table 11: Analysis of Covariance of the Treatment and Control Group 7th-Grade Post-test Scores by Student Gender

Source	Type III Sum of Squares	df	Mean Square	F	Significance
Corrected Model	473959.752	6	78993.292	101.301	<.01
Intercept	12692.355	1	12692.355	16.277	<.01
Pre-test	423514.124	1	423514.124	543.113	<.01
Study Group	3687.339	1	3687.339	4.729	.030
Gender	2222.335	2	1111.168	1.425	.242
Error	362602.511	465	779.790		
Total	226591954.000	472			
Corrected Total	836562.263	471			

Table 12: Descriptive Statistics Comparison of the Treatment and Control Group 7th-grade Post-test Scores (Adjusted for Pre-test Performance) by Student Gender

Group	Number of Students	Post-test Scores	
		Mean	Standard Deviation
Treatment			
Female	111	695.4	33.6
Male	116	695.0	45.2
Not Reported	1	733.5	N/A
Control			
Female	80	686.7	39.4
Male	88	683.6	50.6
Not Reported	76	689.9	32.9

Seventh-grade Ethnicity Results

We also examined whether there were any differential effects among 7th-grade students of different ethnicities. To accomplish this, we conducted analysis of covariance (ANCOVA) similar to the overall analysis, but including ethnicity in the model. As in the overall analysis, we used the pre-test score as the covariate so that the post-test scores could be more fairly compared.

There was no significant effect for the interaction between ethnicity and study group membership (F = 0.596, p = .70). This suggests that Achieve3000 Math is equally effective for seventh-graders of varying ethnicities. The results are provided in Tables 13 and 14.

Table 13: Analysis of Covariance of the Treatment and Control Group 7th-Grade Post-test Scores by Student Ethnicity

Source	Type III Sum of Squares	df	Mean Square	F	Significance
Corrected Model	479065.872	12	39922.156	51.257	<.01
Intercept	13248.304	1	13248.304	17.010	<.01
Pre-test	371903.162	1	371903.162	477.497	<.01
Study Group	130.582	1	130.582	.168	.682
Ethnicity	1519.036	5	303.807	.390	.856
Study Group * Ethnicity	2321.413	5	464.283	.596	.703
Error	357496.390	459	778.859		
Total	226591954.000	472			
Corrected Total	836562.263	471			

Table 14: Descriptive Statistics Comparison of the Treatment and Control Group 7th-grade Post-test Scores (Adjusted for Pre-test Performance) by Student Ethnicity

Group	Number of Students	Post-test Scores	
		Mean	Standard Deviation
Treatment			
African American	1	678.5	N/A
Asian or Pacific Islander	11	695.1	47.9
Caucasian	149	697.7	36.4
Hispanic	17	687.9	46.1
Mixed Race or Other	24	694.2	46.6
Not Reported	26	695.3	43.5
Control			
African American	35	676.6	24.9
Asian or Pacific Islander	5	694.2	38.8
Caucasian	92	687.3	42.1
Hispanic	11	690.6	51.3
Mixed Race or Other	20	696.3	32.2
Not Reported	81	689.1	38.4

Teacher Survey Results

SEG collected qualitative data from the teacher participants through an end-of-year survey. All teachers were asked a series of questions about their background. Teachers who used Achieve3000 Math and who participated in the quantitative study as well as additional teachers who used Achieve3000 Math but did not participate in the quantitative study were asked detailed questions about Achieve3000 Math and its effects on student learning.

Fifty-two teachers (39 Treatment (Achieve3000 Math users) and 13 Control) completed at least part of the survey. The demographic profile of the teachers is summarized in Table 15.

Table 15: Profile of Survey Teacher Participants

	Treatment	Control
Gender		
Female	87%	54%
Male	13	46
Ethnicity		
African American	3	23
Asian or Pacific Islander	0	0
Caucasian	89	62
Hispanic	5	15
Mixed Race or Other	3	0
Teaching Experience		
This is my first year	8	15
2 – 4 years	15	23
5 – 9 years	13	31
10 – 14 years	21	8
15 – 24 years	31	23
25 or more years	13	0
Highest Degree		
Bachelor's	46	38
Master's	54	62

Achieve3000 Math Usage

Teachers reported the various locations in which their students used Achieve3000 Math. Ninety-seven percent of the teachers indicated that the students used Achieve3000 Math in the classroom. Fifty-six percent reported that the students used Achieve3000 Math at home. Eight percent reported using Achieve3000 Math in a computer lab.

The average number of minutes spent using Achieve3000 Math each week was 73 minutes. The average number of weeks that students used Achieve3000 Math during the study was 14 weeks. The average number of weeks that teachers used Achieve3000 Math during the study was 13 weeks.

Achieve3000 Math Feedback

The teachers who used Achieve3000 Math between January and June 2015 responded to a series of questions regarding Achieve3000 Math usage, features, and outcomes. For each question, the teachers were asked to rate their agreement from Strongly Agree to Strongly Disagree. For those questions that did not apply, the teachers were able to respond that the question did not apply to their use of Achieve3000 Math.

The teachers were asked to provide information regarding their students' use of Achieve3000 Math. Sixty-six percent of the teachers indicated that their students found Achieve3000 Math useful in learning math. Similarly, sixty-six percent of the teachers indicated that their students were engaged when using Achieve3000 Math. The teacher ratings regarding their students' use of Achieve3000 Math are provided in Table 16.

Table 16: Teachers' Feedback Regarding Their Students' Use of Achieve3000 Math

Statement	Strongly Agree	Agree	Neither Agree Nor Disagree	Disagree	Strongly Disagree	Do Not Know/ Does Not Apply
My students enjoyed using Achieve3000 Math.	2.9%	40.0%	31.4%	20.0%	5.7%	0.0%
My students found Achieve3000 Math useful in learning math.	2.9	62.9	25.7	5.7	2.9	0.0
My students were engaged when using Achieve3000 Math.	11.4	54.3	22.9	5.7	5.7	0.0
Achieve3000 Math helped my students learn and practice math concepts and skills.	14.3	71.4	11.4	0.0	2.9	0.0
My students asked to use Achieve3000 Math.	0.0	20.0	28.6	34.3	17.1	0.0
My students found Achieve3000 Math easy to use.	5.7	31.4	37.1	20.0	5.7	0.0
My students used the hints included in the steps.	5.7	65.7	20.0	8.6	0.0	0.0
My students watched the videos when provided.	0.0	54.3	25.7	14.3	2.9	2.9
Achieve3000 Math helped my students do better on statewide required tests.	0.0	17.1	60.0	0.0	0.0	22.9
Achieve3000 Math improved my students' math fluency.	0.0	34.3	51.4	8.6	0.0	5.7

Teachers were asked to provide feedback regarding their use of Achieve3000 Math. Questions covered topics including usage of Achieve3000 Math, quality of features of Achieve3000 Math, and impact on teaching. The teacher ratings are provided in Table 17. Some of the highlights of the feedback include:

- ✓ Seventy-seven percent of the teachers indicated that Achieve3000 Math was well aligned to their math instructional goals.
- ✓ Eighty-three percent indicated that Achieve3000 Math was well aligned to Common Core State Standards.
- ✓ Eighty-six percent of the teachers indicated that it was easy for them to create classes and assignments in Achieve3000 Math.
- ✓ Seventy-three percent of the teachers indicated that it was easy to determine who needed intervention with Achieve3000 Math.

Table 17: Teachers' Feedback Regarding Achieve3000 Math

Statement	Strongly Agree	Agree	Neither Agree Nor Disagree	Disagree	Strongly Disagree	Do Not Know/ Does Not Apply
Achieve3000 Math was easy to use.	17.1%	51.4%	20.0%	11.4%	0.0%	0.0%
The instructions for Achieve3000 Math were clear.	14.3	54.3	14.3	17.1	0.0	0.0
Achieve3000 Math was well aligned to my math instructional goals.	20.0	57.1	14.3	8.6	0.0	0.0
Achieve3000 Math was well aligned to the Common Core State Standards for Mathematics.	28.6	54.3	11.4	5.7	0.0	0.0
The Achieve3000 Math concepts were at the appropriate level of difficulty for my students.	5.7	57.1	20.0	14.3	2.9	0.0
Achieve3000 Math has made my teaching easier.	0.0	25.7	65.7	5.7	2.9	0.0
Achieve3000 Math has made my teaching more effective.	2.9	25.7	62.9	5.7	2.9	0.0
It was easy to create classes and assignments.	20.0	65.7	8.6	5.7	0.0	0.0
It was easy to configure Achieve3000 Math for my class.	11.4	71.4	11.4	5.7	0.0	0.0
I was able to track my students' and classes' progress over time.	5.7	65.7	17.1	11.4	0.0	0.0
I was able to transition seamlessly between other classroom activities and Achieve3000 Math.	20.6	47.1	29.4	2.9	0.0	0.0
I needed help in order to use Achieve3000 Math.	2.9	14.7	17.6	61.8	2.9	0.0
It was easy to identify who needed intervention with Achieve3000 Math.	2.9	70.6	11.8	11.8	0.0	2.9
The step-by-step tutoring was helpful to my students.	8.8	38.2	26.5	20.6	2.9	2.9
It was easy to identify prerequisite concepts students were missing with Achieve3000 Math.	2.9	58.8	20.6	14.7	0.0	2.9
My class' homework completion rate increased because of Achieve3000 Math.	0.0	5.9	38.2	47.1	5.9	2.9
Achieve3000 Math's reports were clear and easy to understand.	2.9	47.1	26.5	20.6	0.0	2.9
I am confident my students mastered the concepts covered by Achieve3000 Math.	0.0	23.5	58.8	14.7	0.0	2.9

After providing overall feedback regarding Achieve3000 Math, the teachers were asked to rate the effectiveness of the skills covered in Achieve3000 Math. Teachers provided ratings for skills within a concept that their students used during Spring 2015. Expressions and Equations was the most commonly used domain and Statistics and Probability was the least commonly used domain.

Within the Expressions and Equations domain, the teachers indicated that Achieve3000 Math's coverage of the skills was generally effective. Order of Operations had the highest effectiveness rating (93% of teachers indicated Achieve3000 Math's coverage of this skill was somewhat or very effective). The complete set of ratings regarding the effectiveness of Achieve3000 Math for skills within Expressions and Equations is provided in Table 18.

Table 18: Teacher Ratings of the Effectiveness of Problems Within Expressions and Equations

Skill	N	Very Effective	Somewhat Effective	Neither Effective nor Ineffective	Somewhat Ineffective	Very Ineffective
Expressions with Exponents	24	20.8%	66.7%	12.5%	0.0%	0.0%
Evaluate Expressions	25	24.0	64.0	12.0	0.0	0.0
Distributive Property	26	15.4	69.2	0.0	11.5	3.8
Equivalent Expressions	25	16.0	72.0	8.0	4.0	0.0
Order of Operations	27	29.6	62.9	3.7	3.7	0.0
Evaluate Formulas	24	25.0	58.3	12.5	4.2	0.0
Use Substitutions	24	16.7	70.8	8.3	4.2	0.0
Use Variables to Write Expressions	26	23.1	65.4	7.7	3.8	0.0
Write/Solve Equations	23	26.1	56.5	13.0	4.3	0.0
Represent Solutions	20	10.0	70.0	15.0	5.0	0.0
Use Variables to Represent Two Quantities	18	16.7	61.1	16.7	5.6	0.0
Analyze Relationships	18	16.7	55.6	22.2	5.5	0.0
Apply Properties	18	16.7	61.1	16.7	5.6	0.0
Graph Inequalities	20	15.0	60.0	20.0	5.0	0.0

Within the Geometry domain, the teachers indicated that Achieve3000 Math's coverage of the skills was generally effective. Construct Triangles and Draw Geometric Shapes had the highest effectiveness rating (100% of teachers indicated Achieve3000 Math's coverage of these skills was somewhat or very effective). The complete set of ratings regarding the effectiveness of Achieve3000 Math for skills within Geometry is provided in Table 19.

Table 19: Teacher Ratings of the Effectiveness of Bops Within Geometry

Skill	N	Very Effective	Somewhat Effective	Neither Effective nor Ineffective	Somewhat Ineffective	Very Ineffective
Find Area of Polygons by Decomposing	22	18.2%	68.2%	13.6%	0.0	0.0
Find Area of Triangles	25	36.0	52.0	12.0	0.0	0.0
Find Volume	24	25.0	66.7	8.3	0.0	0.0
Use Coordinates to Find Side Lengths	16	18.8	62.5	12.5	6.3	0.0
Side Length Problems	15	6.7	73.3	13.3	6.7	0.0
Draw Polygons in Coordinate Plane	14	21.4	50.0	21.4	7.1	0.0
Use Nets to Find Surface Area	19	15.8	73.7	10.5	0.0	0.0
Solve Surface Area Problems	21	19.0	66.7	9.5	4.8	0.0
Solve Scale Drawing Problems	11	9.1	81.8	9.1	0.0	0.0
Construct Triangles	6	83.3	16.7	0.0	0.0	0.0
Draw Geometric Shapes	6	66.7	33.3	0.0	0.0	0.0
Describe 2-D Figures of 3-D Shape Slices	11	9.1	54.5	27.3	9.1	0.0
Find Circumference/Area	13	15.4	61.5	23.1	0.0	0.0
Solve Angle/Relationship Problems	13	23.1	61.5	7.7	7.7	0.0
Find Area/Surface Area/Volume	23	17.4	69.6	13.0	0.0	0.0
Find Area/Surface Area/Volume of Composed Shapes	17	5.9	76.5	17.6	0.0	0.0

Within the Ratios and Proportional Relationships domain, the teachers indicated that Achieve3000 Math's coverage of the skills was generally effective. Represent Proportions had the highest effectiveness rating (91% of teachers indicated Achieve3000 Math's coverage of this skill was somewhat or very effective). The complete set of ratings regarding the effectiveness of Achieve3000 Math for skills within Ratios and Proportional Relationships is provided in Table 20.

Table 20: Teacher Ratings of the Effectiveness of Problems Within Ratios and Proportional Relationships

Skill	N	Very Effective	Somewhat Effective	Neither Effective nor Ineffective	Somewhat Ineffective	Very Ineffective
Unit Rates	28	35.7%	53.6%	7.1%	3.6%	0.0%
Equivalent Ratios in Tables/Graphs	26	34.6	46.2	15.4	3.8	0.0
Find Percents	23	26.1	60.9	13.0	0.0	0.0
Find Wholes	19	31.6	52.6	5.3	10.5	0.0
Use Ratios	27	29.6	55.6	11.1	3.7	0.0
Compute Rates	23	26.1	47.8	17.4	8.7	0.0
Identify Rates	24	25.0	50.0	20.8	4.2	0.0
Represent Proportions	21	28.6	61.9	4.8	4.8	0.0
Explain Proportions	18	27.8	50.0	11.1	11.1	0.0
Proportional Relationships	23	39.1	34.8	17.4	8.7	0.0
Use Proportions	25	28.0	60.0	8.0	4.0	0.0

Within the Statistics and Probability domain, the teachers indicated that Achieve3000 Math's coverage of the skills was generally effective. Many of the skills were rated by 100% of the teachers as being somewhat or very effective. The complete set of ratings regarding the effectiveness of Achieve3000 Math for skills within Statistics and Probability is provided in Table 21.

Table 21: Teacher Ratings of the Effectiveness of Problems Within Statistics and Probability

Skill	N	Very Effective	Somewhat Effective	Neither Effective nor Ineffective	Somewhat Ineffective	Very Ineffective
Describe Data Distribution	6	33.3%	50.0%	16.7%	0.0%	0.0%
Display Data	7	57.1	28.6	14.3	0.0	0.0
Justify Choice of Measure to Summarize Data	5	60.0	20.0	20.0	0.0	0.0
Summarize Data: Measures of Centers	7	57.1	42.9	0.0	0.0	0.0
Summarize Data: Measures Variability	6	50.0	33.3	16.7	0.0	0.0
Interpret Population Generalizations Based on Samples	6	50.0	33.3	16.7	0.0	0.0
Use Samples to Draw Inferences	7	14.3	57.1	28.6	0.0	0.0
Compare Measures of Center	7	57.1	42.9	0.0	0.0	0.0
Use Measures of Center/Variability to Make Inferences	4	50.0	50.0	0.0	0.0	0.0
Find Probabilities From Single Event Uniform Models	11	36.4	63.6	0.0	0.0	0.0
Compare Model Probabilities to Observed Frequencies	4	75.0	25.0	0.0	0.0	0.0
Represent Sample Spaces for Compound Event	5	40.0	60.0	0.0	0.0	0.0
Interpret Sample Spaces for Compound Event	5	60.0	40.0	0.0	0.0	0.0
Determine Probabilities of Compound Events	8	37.5	62.5	0.0	0.0	0.0

Within the Number System domain, the teachers indicated that Achieve3000 Math's coverage of the skills was generally effective. Divide Fractions and Decimal Multiplication had the highest effectiveness rating (95% of teachers indicated Achieve3000 Math's coverage of these skills was somewhat or very effective). The complete set of ratings regarding the effectiveness of Achieve3000 Math for skills within Number System is provided in Table 22.

Table 22: Teacher Ratings of the Effectiveness of Problems Within Number System

Skill	N	Very Effective	Somewhat Effective	Neither Effective nor Ineffective	Somewhat Ineffective	Very Ineffective
Divide Fractions	21	23.8%	71.4%	4.8%	0.0%	0.0%
Divide Wholes	18	22.2	66.7	5.6	5.6	0.0
Decimal Addition/Subtraction	17	29.4	64.7	5.9	0.0	0.0
Decimal Multiplication	18	27.8	66.7	5.6	0.0	0.0
Decimal Division	20	25.0	60.0	10.0	5.0	0.0
Find Factors/Multiples	14	28.6	57.1	0.0	7.1	7.1
Distributive Property	21	14.3	61.9	4.8	14.3	4.8
Positive/Negative Quantities	18	27.8	61.1	5.6	5.6	0.0
Write Statements of Order	13	15.4	69.2	7.7	7.7	0.0
Find Distance	11	9.1	45.5	27.3	18.2	0.0
Graph Points	16	37.5	50.0	6.3	6.3	0.0
Graph Coordinates	16	37.5	50.0	6.3	6.3	0.0
Position Integers/Rationals	17	23.5	58.8	11.8	5.9	0.0
Absolute Value Magnitude	17	41.2	35.3	11.8	11.8	0.0
Number Line Operations	18	27.8	61.1	5.6	5.6	0.0
Compute Rationals	15	6.7	73.3	13.3	6.7	0.0
Use Properties to Multiply/Divide Rationals	14	7.1	78.6	7.1	7.1	0.0
Operations With Rationals	16	12.5	81.3	0.0	6.3	0.0
Interpret Quotients	11	9.1	81.8	0.0	9.1	0.0
Convert Rationals	12	8.3	66.7	16.7	8.3	0.0

Teachers were asked whether they were likely to use Achieve3000 Math again in the future and whether they would recommend Achieve3000 Math to other teachers. Ninety percent of the teachers responding indicated agreement that they would use Achieve3000 Math again in the future. One hundred percent of the teachers responding indicated agreement that they would recommend Achieve3000 Math to other teachers. The likelihood of future use is depicted in Figure 3 and the likelihood of recommending is depicted in Figure 4.

Figure 3: Likelihood of Using Achieve3000 Math in the Future

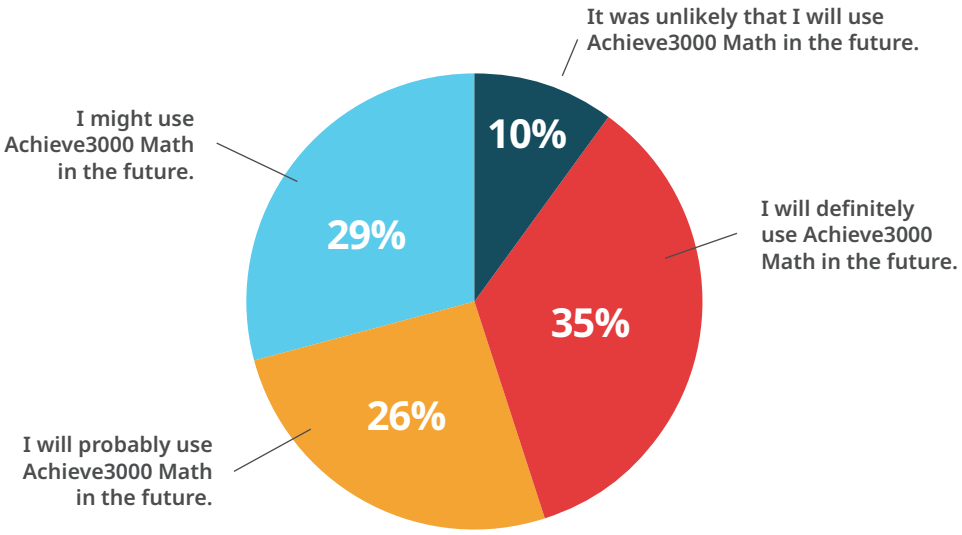
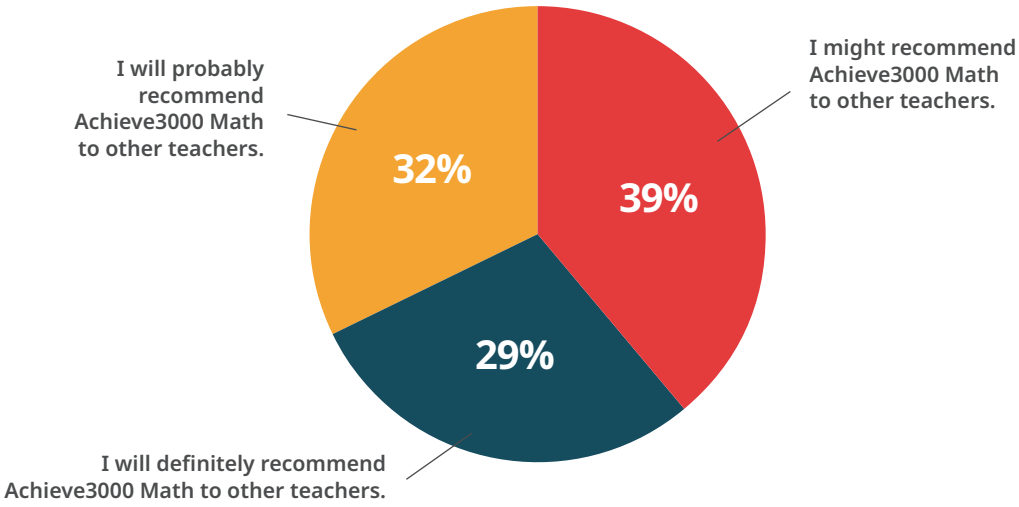


Figure 4: Likelihood of Recommending Achieve3000 Math



Conclusion

A multi-method study of the impact of Achieve3000 Math use conducted during the 2014-2015 school year supports the effectiveness of Achieve3000 Math for 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=.16, Effect size for 7th-grade=.20). These results were found with Achieve3000 Math usage of at least 60 minutes on average each week. The .16 Effect Size found in sixth-grade and .20 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). This means that Achieve3000 Math users in sixth-grade showed 40% more growth in mathematics than is typically expected (.15/.41). Seventh-grade Achieve3000 Math users showed 66% more growth in mathematics than is typically expected (.20/.30). Teachers reported that Achieve3000 Math was effective in helping students improve their ability in a variety of skills covered within the domains of grade 6 and 7 mathematics.

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

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.

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**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.*