A Study of the IMPACT of the Atomic Learning Professional Development Solution on Student Achievement

Improving Student Learning Through Teacher Technology Integration Training

Research & Analysis by SEG Measurement,
New Hope, PA

SEG
The Measurable Difference

INTRODUCTION

Schools are under increasing pressure to implement the Common Core Standards and to develop students' career and college readiness skills. One way to achieve these goals is through the effective integration of technology in instruction which requires extensive teacher training and professional development. In fact, the 2011 Horizon Report on the outlook for education technology identifies digital literacy among teachers as the number one challenge faced by education. Atomic Learning offers a comprehensive professional development solution to address this challenge.

During the 2010-2011 school year, SEG Measurement conducted a year-long, multi-site study with approximately 1,000 6th, 7th and 8th grade teachers and students in 42 classrooms in Minnesota, Missouri and Texas, to evaluate the impact of the Atomic Learning professional development solution on student achievement. Atomic Learning provides a portfolio of online tools to assist teachers in providing technology integrated instruction to foster student achievement and college and career readiness.

The goal of this study was to evaluate the impact of Atomic Learning's technology integration training on student learning. The results show that students in classes whose teachers use Atomic Learning learn significantly more than students in classes whose teachers do not use Atomic Learning.

Students in classes with teachers who were Atomic Learning users showed about a year more of growth in Language Arts and in Mathematics than students in classes with teachers that did not use Atomic Learning. The Atomic

Teachers using Atomic Learning reported a ***substantial increase in technology use*** *and increased technology integration in the classroom*

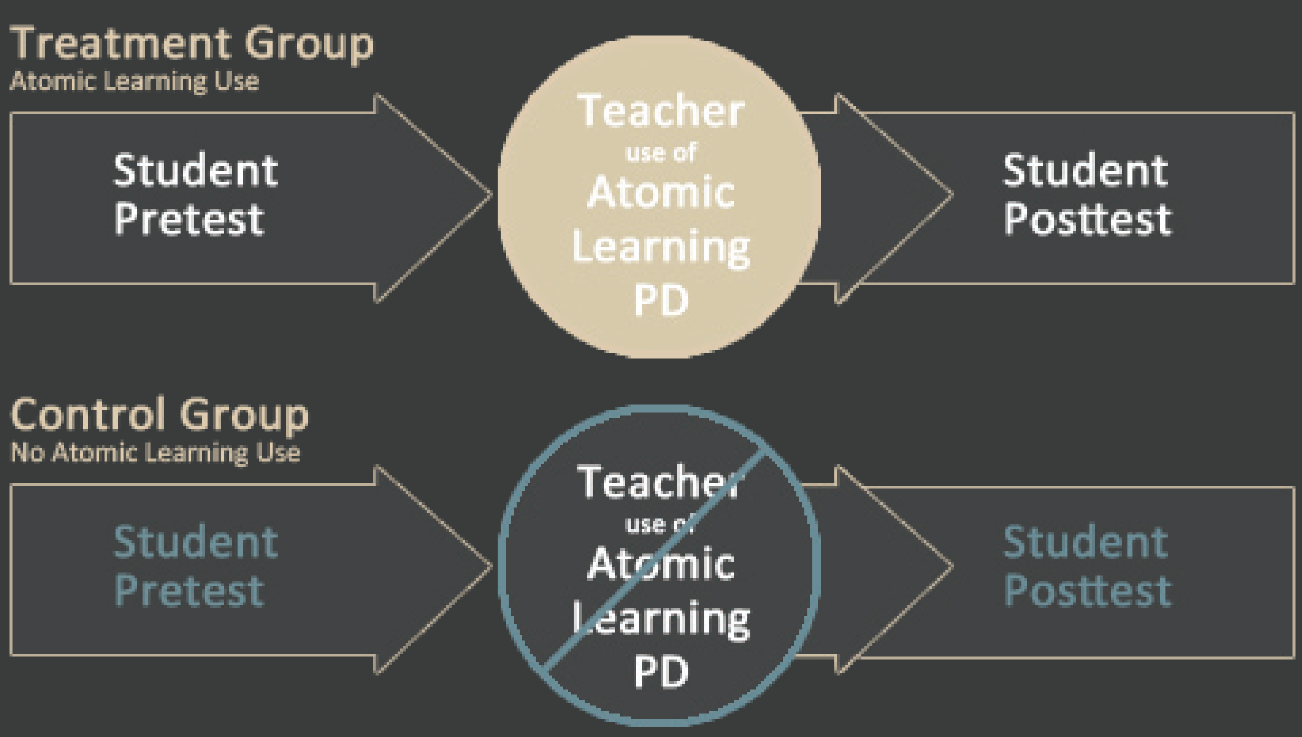
Learning-trained teachers made substantial use of technology in the delivery of instruction, and provided assignments and projects that required students to integrate technology into their work.

STUDY DESIGN

The primary question answered by this study is: Do students in grades 6, 7, and 8 show larger gains in Reading Comprehension and Mathematics skills if their teachers use Atomic Learning for professional development? The study also explored potential differences in growth between boys and girls and among students of different ethnic backgrounds.

The study compared two groups of teachers and students, matched in ability. The Treatment Group consisted of students in classes whose teachers used the Atomic Learning professional development solution; the Control Group consisted of students in classes whose teachers did not use Atomic Learning. The students in both groups were administered a pretest at the beginning of the year and a posttest at the end of the year to evaluate the impact of teacher use of Atomic Learning on their Reading Comprehension and Mathematics growth. This is illustrated below.

FIGURE 1



Students in Atomic Learning classes, on average, achieved about ***two years of growth***

The study compared the growth in Reading Comprehension and Mathematics Stanford 10 Achievement Test™ scores from the beginning of the school year to the end of the school year.

The results from the pretest and posttest were compared statistically to determine the level of growth in Reading Comprehension and Mathematics skills.

IMPLEMENTATION

Teachers of students in the Treatment Group used Atomic Learning about one to two hours weekly, while teachers of students in the Control Group did not use Atomic Learning. Teachers using Atomic Learning reported a substantial increase in technology use and increased technology integration in the classroom. Several teachers reported an increased willingness to use technology in the classroom and several teachers integrated mobile devices such as iPads and iPods.

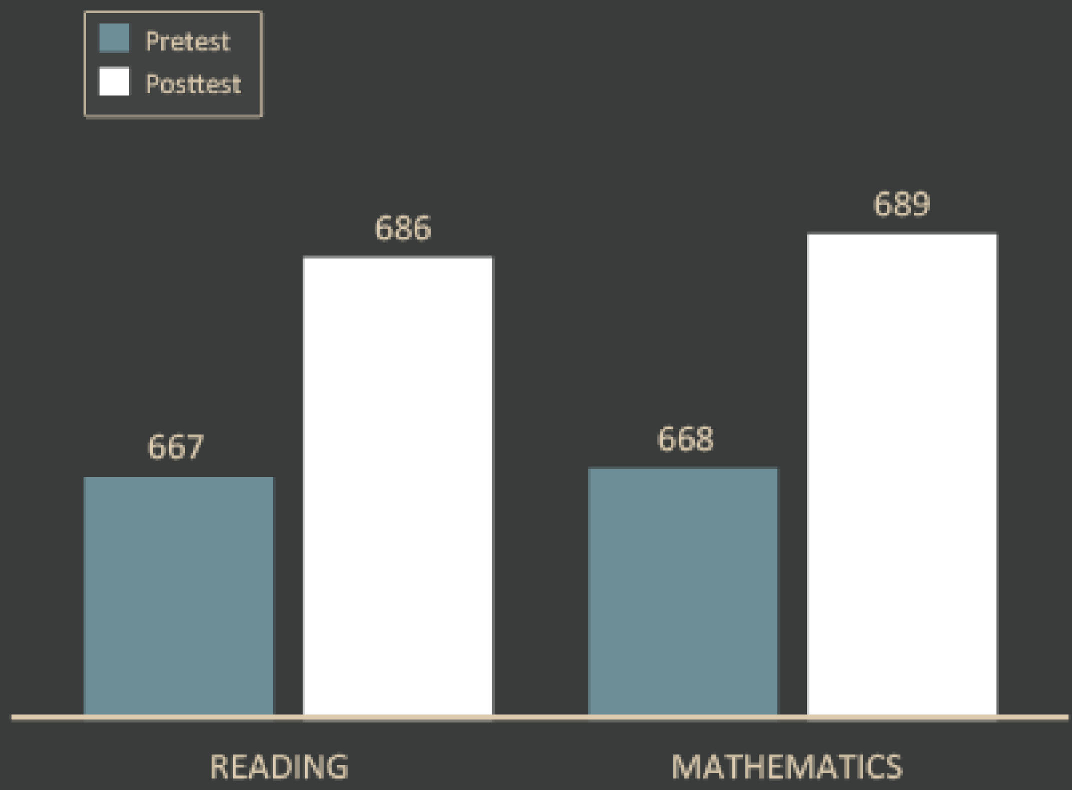
One school shifted from a model of offering specific classes in technology use to a broader integration of technology across all classes. To support broader student technology learning, students are required to present projects using multiple modes and are encouraged not to repeat use of the same medium for project presentations. This school also reported broader use of videoconferencing and Skype for teachers and students.

RESULTS

The Treatment Group students whose teachers used Atomic Learning showed substantial growth in Reading Comprehension and Mathematics during the course of the study (see Figure 2). Students in the Treatment Group increased their SAT 10 Reading Comprehension scale-scores by 19 points and their Mathematics scale-scores

FIGURE 2

Comparison of Student SAT 10 Pretest and Posttest Scores in Classes where Teachers used Atomic Learning for Professional Development



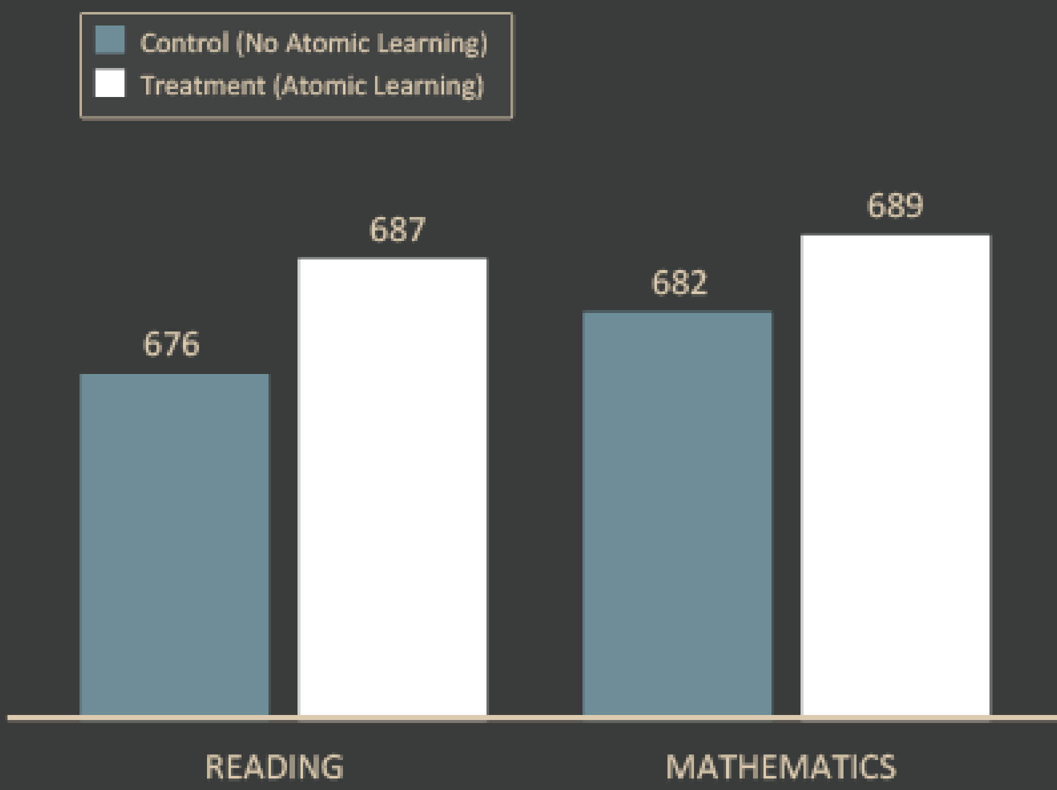
by 21 points. This means that they, on average, achieved about two years of growth (for the typical student at the 50th percentile) during the year in which the study was conducted.

The greater academic growth observed for students in the Treatment Group becomes even more visible when comparing these students against the Control Group. Students in the Treatment Group showed statistically greater gains in both Reading Comprehension and Mathematics than the Control Group.

The Treatment Group students showed substantially greater gains in Reading Comprehension (11 scale score points; Effect Size= .24) and Mathematics (7 scale score points; Effect Size=.14) than the Control Group classes (see Figure 3).

FIGURE 3

Comparison of Student SAT 10 Test Scores in Classes where Teachers used Atomic Learning to Classes where Teachers did not



This means that, on average, students in the Treatment Group showed about a year's more growth than their peers in classes where Atomic Learning was not used.

These effects indicate that the use of Atomic Learning for professional development has a substantial impact on student Reading Comprehension and Mathematics skills growth.

The solution was found to be equally effective for boys and girls and for students of different ethnicities.

SUMMARY

Students who were in classes whose teachers used Atomic Learning showed substantial growth in Reading Comprehension and more moderate gains in Mathematics during the course of the study. Students in Treatment Group classes increased their SAT 10 scores between 19 and 21 points, or about two years' worth of growth.

More significantly, Treatment Group students enrolled in classrooms whose teachers used Atomic Learning showed about a year's more growth in Reading Comprehension and Mathematics than the Control Group students enrolled in classes where teachers did not use Atomic Learning.

The Atomic Learning professional development solution users finished the year with scores that were 11 scale-score points higher in Reading Comprehension and 7 scale-score points higher in Mathematics on the SAT 10 assessments. The study also found that Atomic Learning is equally effective for boys and girls and for students of different ethnic backgrounds.

The findings of this study provide substantial support for the effectiveness of Atomic Learning in improving student Reading Comprehension and Mathematics skills.

Atomic Learning is ***equally effective*** *for boys and girls, and students of different ethnic backgrounds.*

Overview & Background

Despite the ubiquity of technology in society as a whole and in students' daily lives, ***technology remains a periphery of the school***

Few disagree that improving student's academic skills is among the most important goal of creating college and career-ready students. Growth in academic skills, particularly in the core content areas, remains a critical part of the educational mission, and the tools available to achieve this goal are changing—most notably, technology.

Technology is central to the lives of today's students; they are fundamentally different than those of even a decade ago. The students we see in the classroom today are "digital natives." They have grown up with technology around them rather than being forced to learn the technology later in life (Prensky, 2010).

Despite the ubiquity of technology in society as a whole and in students' daily lives, technology often remains at the periphery of the school. One of the primary reasons technology has not yet reached its full potential in the schools is that teachers often lack the knowledge and skills to use technology effectively. Many teachers do not have the basic tools to communicate with their students.

Teachers not only need to understand how to use technology in their teaching, they need to understand how to help students use technology to help guide their own learning. Teachers need to provide students with cognitive tools to learn both within and outside the classroom (Collins and Halverson, 2009).

Moving from a 19th century factory-based model of school to a 21st century approach to learning requires a significant commitment to professional development. Schools need the right tools for professional development to improve teachers' technology skills, teachers' ability to develop those skills in students, and teacher's integration of technology with students to facilitate learning. The single greatest impact on improved student achievement is increased teacher education (Borthwick and Pierson, 2008).

Teachers need a very different set of skills than the factory-based model required; they can no longer rely on lecture and other one-way methods of delivery, and must instead become learning facilitators. This change does not come easily and demands that teachers have the technology skills to help students use technology to learn. Professional development will foster these changes.

The research is clear: students achieve more when taught by teachers who receive technology training. In a 1999 study reported by Schacter, students with teachers receiving any technology training during the past five years academically outperformed their peers whose teachers had not had any technology training during that period.

Owen, Farsali, Knezak, and Christensen (2005) conducted a large-scale study of technology and student learning in Irving Texas. The conclusion? Students learn more, and report being more engaged, in schools that are actively engaged in professional development for teachers focused on technology use and the application of technology to new ways of teaching and learning.

Most of the 8 million U.S. teachers do not have the skills necessary to teach today's tech savvy students. One study suggests that fewer than 7% of schools have teachers who are technologically literate enough to effectively integrate technology into their lessons (Sparks, 2006). This 2006 study by Sparks also found that 36% of the schools provide no professional development for technology and another 29% provide only 1-14 hours a year.

The 2011 Horizon Report on the outlook for education technology confirms this picture. The analysis, conducted by the New Media Consortium (NMC), the International Society for Technology in Education (ISTE®) and the

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Consortium for School Networking (CoSN), identifies digital literacy among teachers as the number one challenge faced by education. "The challenge is due to the fact that despite the widespread agreement on its importance, training in digital literacy skills and techniques is rare in teacher education and school district professional development programs." "As teachers begin to realize that they are limiting their students by not helping them to develop and use digital media literacy skills across the curriculum, the lack of formal training is being offset through professional development or informal learning, but we are far from seeing digital media literacy as a norm."

Recognizing the growing role of technology in education and the challenges presented in technology integration training for teachers, this research study sought to investigate the impact of a selected technology integration professional development solution for teachers (Atomic Learning) on student academic performance.

This report describes a study conducted during the 2010-2011 school year to evaluate the impact of teacher technology training using Atomic Learning on student achievement. Specifically, the study compares the growth in academic skills of students in grades 6, 7 and 8 in classes whose teachers used Atomic Learning (Treatment Group) to those in classes whose teachers did not use Atomic Learning (Control Group). The study compared student academic growth in the Treatment and Control Groups. We compared the growth in Reading Comprehension and Mathematics attained by students in the Treatment Group and Control Group between the beginning and end of the 2010-2011 school year, as measured by the growth in Stanford 10 Achievement Test™ Abbreviated Battery (SAT 10) scores.

RESEARCH QUESTIONS

This study investigated the following questions:

1. Do students in grades 6, 7, and 8 show larger gains in Reading Comprehension and Mathematics skills if their teachers use Atomic Learning for professional development?

2. Are there any differences in the Reading Comprehension and Mathematics skills between boys and girls in classes whose teachers use Atomic Learning as compared to classes where teachers do not use Atomic Learning?

3. Are there any differences in the Reading Comprehension and Mathematics skills among ethnic groups in classes whose teachers use Atomic Learning as compared to classes where teachers do not use Atomic Learning?

STUDENT SAMPLE

Between September 2010 and June 2011, approximately 1,000 students in 42 classrooms in Minnesota, Missouri, and Texas participated in a controlled study of Atomic Learning effectiveness. Students enrolled in classes whose teachers used Atomic Learning constituted the Treatment Group.   Students enrolled in classes whose teachers did not use Atomic Learning constituted the Control Group. There were approximately 629 students in the Treatment Group and approximately 240 students in the Control Group. (Approximately 71 students could not be classified as Treatment or Control and were treated as missing data.) Table 1 shows the number of students in each gender, ethnic, and grade category. (The total number of students listed for each background variable may be different since some schools were unable to provide complete background information.)

TABLE 1

Demographic Profile of Student Participants

Variable	Number (N) of Students	Percentage of Students
Gender		
Male	435	52%
Female	401	48%
Total (All Gender)	*836*	
Ethnicity		
Caucasian	680	83%
African American	25	3%
Hispanic	59	7%
Asian/Pacific Islander	15	2%
Mixed Race and Other	45	6%
Total (All Ethnicity)	*824*	
Grade Level		
Grade 6	166	19%
Grade 7	312	36%
Grade 8	390	45%
Total (All Grades)	*868*	

In some cases, teachers did not provide complete background information for a student or a student did not take one of the tests included in the analyses. Where data was missing, the student's results were eliminated from those analyses.

COMPARABILITY OF STUDY GROUPS

It is very important in a study comparing student academic growth to establish at the outset that the Treatment Group and Control Group are similar, particularly with respect to student academic ability, the outcome of interest. Demonstrating baseline equivalence of the sample (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, teachers' use of Atomic Learning) or the result of some differences in the individuals that existed before we conducted the study.

Ideally, this matching is accomplished by sampling study participants of similar reading and math ability. However, any observed differences can be adjusted for statistically using analysis of covariance (ANCOVA). The Treatment Group and Control Group were compared with respect to initial Reading Comprehension and Mathematics ability, as well as their gender and ethnicity. The results indicate that the groups were similar in ability (see Table 2) and background (see Tables 3, 4 and 5).

Ability Comparison

The SAT 10 pretest scores were used to compare the initial Reading Comprehension and Mathematics levels for students in both the Treatment and Control Groups. The mean test scores for students in both Groups are presented in Table 2.

TABLE 2

Comparison of Initial Reading Comprehension and Mathematics Skill Levels (SAT 10 Scores) for the Treatment Group and Control Group

	Reading Comprehension Mean	Reading Comprehension Standard Deviation	Mathematics Mean	Mathematics Standard Deviation
Treatment Group	666.75	46.59	667.97	48.19
	(N = 620)		*(N = 614)*	
Control Group	668.68	43.24	668.34	47.80
	(N = 237)		*(N = 225)*	

The Treatment and Control Groups were comparable in ability. There were no statistically significant differences in the Means between the Treatment and Control groups for Reading Comprehension (T=-.55, df=1/855, p<.58) or Mathematics (T=-.10, df=1/837, p<.92). There were no statistically significant differences in the Standard Deviations (Variances) of the Treatment and Control Groups for Reading Comprehension (F=1.90, df=1/855, p<.17) or Mathematics (F=.14, df=1/837, p<.71).

Gender and Ethnicity

The number of female and male students in both the Treatment and Control were computed and compared (see Table 3). A statistical comparison of the two study groups shows that the Treatment Group and Control Group were comparable with respect to gender. There were no statistical differences in the expected and observed frequencies for gender (chi square =3.59 df=1, p<.06).

TABLE 3

Comparison of Gender Composition

	Female (N)	Female %	Male (N)	Male (%)	Total
Treatment Group	323	74%	274	68%	597
Control Group	112	26%	127	32%	239
TOTAL	***435***	***100%***	***401***	***100%***	***836***

The number of Caucasian and Non-Caucasian students in both the Treatment and Control were computed and compared (see Table 4). A statistical comparison of the two study groups shows that there was a statistically significant difference in the ethnic composition of the Treatment Group and Control Group (chi square =.13.14, df=1, p<.01). While there were statistical differences, there was still significant representation of both Caucasian and Non-Caucasian students in both the Treatment and Control Group.

TABLE 4

Comparison of Ethnic Composition

	Caucasian (N)	Caucasian %	Non Caucasian (N)	Non Caucasian (%)	Total
Treatment Group	502	74%	84	58%	586
Control Group	178	26%	60	42%	238
TOTAL	*680*	*100%*	*144*	*100%*	*824*

DESCRIPTION OF THE PRETEST AND POSTTEST

The academic growth of students was operationalized as the gains in Reading Comprehension and Mathematics ability between pre and posttest. The students participating in the study were measured using the Reading Comprehension and Mathematics Stanford Achievement Test™, Tenth Edition (SAT 10), Abbreviated Battery, Form A, 2002. The SAT 10 was used as both the pretest and posttest measure; students took the SAT 10 in September or October 2010 at the beginning of the school year and then again at the end of May or in June 2011 at the end of the school year.

The Reading Comprehension and Mathematics subtests of the SAT 10 were used for this study. The Reading Comprehension subtest measures students' achievement within the framework of three types of materials or purposes for Reading: literary, informational, and functional text. Within each type of text, questions measure achievement in four modes of Comprehension: initial understanding, interpretation, critical analysis, and awareness and usage of Reading strategies. The Mathematics subtest measures the mathematics skills typically associated with the mathematic curriculum in US schools. Each subtest is 30 items in length (Stanford Achievement Test Series™, Tenth Edition, Technical manual; Harcourt, 2002).

The SAT 10 measures students' skill levels on a single vertical scale ranging from 200-900. The scale-scores represent equal units; differences between scores at any point in the scale represent the same amount of achievement variation. This allows for an accurate comparison of changes over time. The scale is equivalent across forms and grade levels, to provide an accurate comparison across grade levels; a score at one grade level means that same thing at another grade level.

Reliability and Validity

The reliability of the SAT 10 ranges from .89 to .97 (KR-20 reliability coefficient; Harcourt, 2002). Several validity studies conducted for the SAT 10 have found strong evidence for the validity of SAT 10 scores; for example, content expert review found strong alignment with important Reading skills. Strong relationships were found between the SAT 10 and other measures of Reading ability. For a more complete discussion of the SAT 10 reliability and validity, readers are referred to the SAT 10 Technical Manual (Harcourt, 2002).

DESCRIPTION OF THE TREATMENT

The Treatment in this study was teacher's use of Atomic Learning. Atomic Learning defines the solution as follows:

> *Through a library of thousands of short, online video tutorials and curriculum examples showing successful integration of technology and 21st century skills, Atomic Learning's solution provides professional development when and where it's needed. Atomic Learning is:*
>
> - *Conducted in school settings – Atomic Learning's solution is online to be accessed in both the school and home settings so learning is seamless and readily available.*
> - *Linked to school-wide change efforts – The Atomic Learning library continues to evolve, focusing on emerging ed tech topics and offering the most up-to-do technology training.*
> - *Teacher planned and teacher assisted – With Atomic Learning, teachers are empowered with the training and resources they need to ensure student success.*
> - *Providing differentiated learning opportunities for participants and focused on teacher-chosen goals and activities –Teachers can successfully reach their personal goals with Atomic Learning's prescriptive training features.*
> - *Exhibiting a pattern of demonstration/trial/feedback – Featuring a robust admin tools area, Atomic Learning offers the ability to upload custom content, assign training and monitor progress.*
> - *Including concrete goals and instruction – Aligned to ISTE® NETS standards, Atomic*

Learning offers teacher and student assessments to gauge technology skill levels and application of technology.

- *Ongoing over time – Atomic Learning's just-in-time training is available when needed through an internet connection, and the training will continue to be updated as technology evolves.*
- *Providing ongoing assistance and support on call – Implementation and support from a dedicated service team is included with an Atomic Learning subscription.*

Atomic Learning provides an easy to use, cost-effective way to help schools and teachers acquire 21st century skills. Featuring a guided, step-by-step path for tech integration through online teacher workshops and classroom-ready projects along with just-in-time training on over 205 applications, the Atomic Learning solution is relevant to district and individual technology needs.

An Atomic Learning subscription includes:

- *Tech Integration Projects for seamless classroom integration*
- *21st century skills concept training*
- *Workshops on topics such as Web 2.0, Facebook® for Educators, Effective Online Discussions, and more*
- *Training Spotlights on current ed tech topics to help teachers put it all together*
- *Just-in-time training tutorials on 205+ applications and 50+ assistive tech tools*
- *21st Century Skills teacher assessment to gauge technology skills and provide training paths*
- *Tech Skills Assessment to measure students' ability to apply technology*
- *Evidence of Learning Worksheet for assistive technology integration planning*
- *Facilitated Blended Professional Development courses available*
- *Ability to upload your own custom training content*
- *Reports and Administrator Tools to assign training and monitor progress*
- *Sharing tools to easily integrate resources into any document or Web page*
- *Implementation resources and support by a dedicated service team*

Teachers of students in the Treatment Group used Atomic Learning about one to two hours weekly, while teachers of students in the Control Group did not use Atomic Learning. Teachers using Atomic Learning reported a substantial increase in technology use and increased technology integration in the classroom. Several teachers reported an increased willingness

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to use technology in the classroom and several teachers integrated mobile devices such as iPads and iPods.

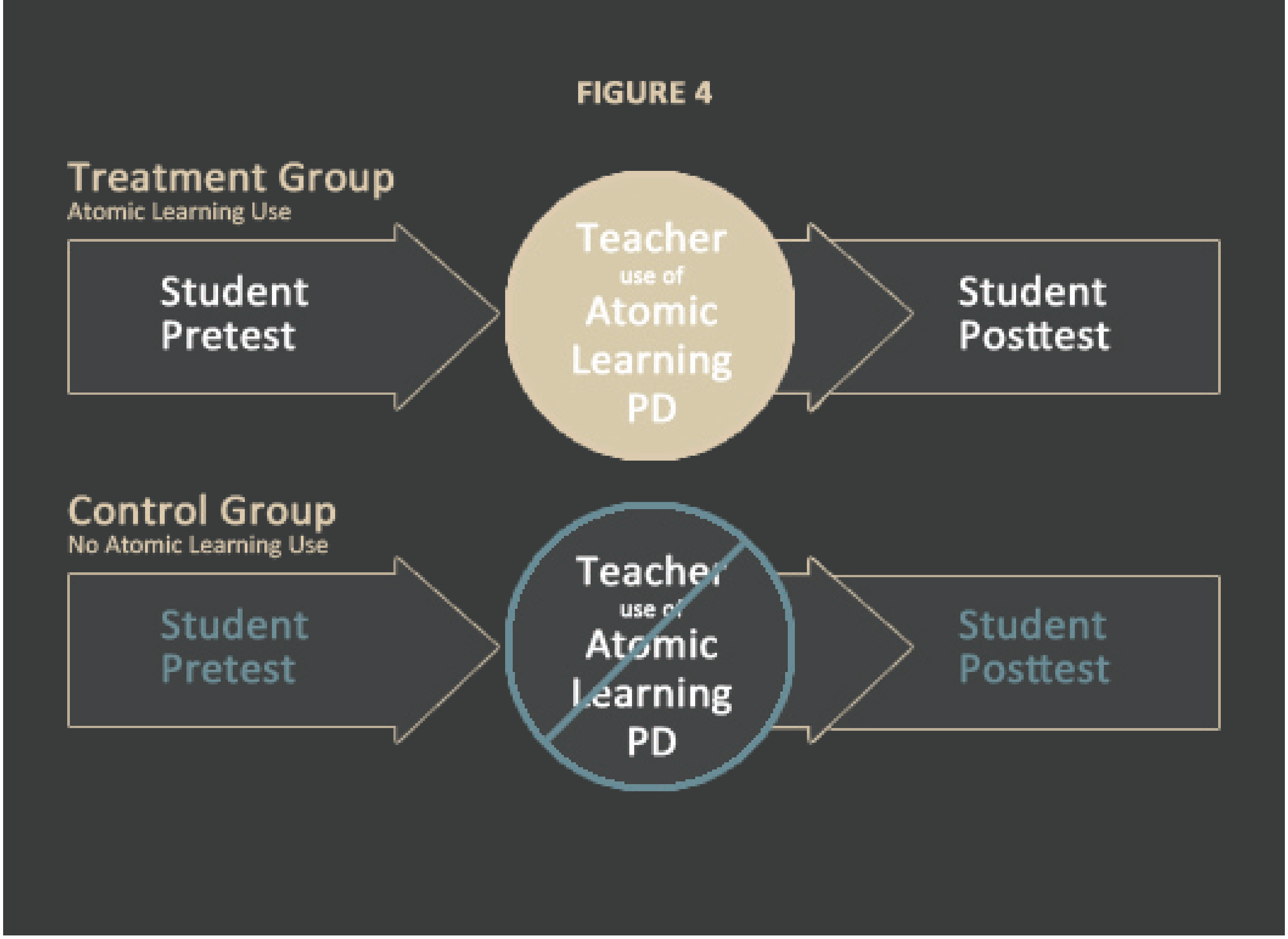
One school shifted from a model of offering specific classes in technology use to a broader integration of technology across all classes. To support broader student technology learning, students are required to present projects using multiple modes and are encouraged not to repeat use of the same medium for project presentations. This school also reported broader use of videoconferencing and Skype for teachers and students.

STUDY DESIGN

The goal of this effectiveness study was to compare the academic growth of students in classes whose teachers used Atomic Learning (Treatment) to students in classes whose teachers did not use Atomic Learning (Control). Academic growth was measured using the Stanford 10 Reading Comprehension and Mathematics Tests. Students' growth in Reading Comprehension and Mathematics was measured by comparing their proficiency at the beginning of the school year (September and October 2010) and again at the end of the school year (May and June 2011).

Students in both the Treatment Group and the Control Group were administered the SAT 10 test as a pretest at the beginning and as a posttest at the conclusion of the school year. Students received approximately 22-28 weeks of instruction between the pretest and posttest. Students in the Treatment Group were taught by teachers who used Atomic Learning, while those in the Control Group received instruction from teachers who did not use Atomic Learning. The results were then compared statistically.

The study employed a pre-post, Treatment-Control Group design. Since the students were not randomly assigned to the groups, this is considered a quasi-experimental design.



Data Collection

At the outset of the study, teachers were asked to provide background information about the participating students in order to characterize the sample, compare the differences between the study groups and facilitate the analysis of the Reading Comprehension and Mathematics gains between the study groups. This information included:

- Student grade level
- Student gender
- Student ethnicity
- Study group membership (Treatment/or Control)

Teachers were also asked to provide some additional demographic and instructional information regarding Individual Education Plans (IEP) and disabilities. Due to the unavailability of information and/or privacy concerns, many teachers did not provide this additional information. Therefore, there was insufficient information to provide additional analyses examining these specific variables.

Teachers participating in the study were provided with SAT 10 test booklets and administration manuals for their grade level in September 2010. The teachers then administered the SAT 10 pretest (Reading Comprehension and Mathematics subtests) according to the administration instructions provided. The completed test booklets and answer sheets were then returned to SEG Measurement for processing. The answer sheets were scanned and entered into a database. Any questions that the students did not answer were scored as incorrect. Students answering fewer than four questions were removed from the analysis. All data was reviewed and checked for accuracy before scoring and analysis.

At the conclusion of the school year, in May or in June 2011, following approximately 22-28 weeks of instruction, teachers administered the SAT 10 posttest (Reading Comprehension and Mathematics subtests). The SAT 10 pretest and posttest results were compared as a basis for evaluating the growth reported in this study.

FINDINGS

Measuring Growth

The growth in Reading Comprehension and Mathematics skills for the Treatment Group and the Control Group was compared using a statistical procedure known as analysis of covariance (ANCOVA). This approach provides an accurate way to compare growth over time controlling for any potential differences in student skills between the two study groups that may have been present at the beginning of the study. Any differences in skill levels between the Treatment Group and Control Group that may have existed at the beginning of the study were controlled to ensure that any differences in subsequent growth were the result of Atomic Learning use and not merely the result of differences that existed at the start of the study. Using this method, we were able to compare differences as if the two groups were matched in initial Reading and Mathematics proficiency. While no procedure can completely eliminate differences that may exist at the outset of a study, ANCOVA is widely recognized as an effective way to control for differences.

Only students for whom matched pretest and posttest results were available were included in the analysis. The analysis looked only at those students who had taken the SAT 10 at the beginning of the second semester of the school year (pretest) and those who had taken the SAT 10 at the end of the school year (posttest). Students who left the class during this period or who joined the class during this period were not included in the growth comparisons.

Pre-Post Growth for Atomic Learning Users

Students who were in classes that used Atomic Learning showed substantial growth from pre- to posttest in Reading Comprehension and Mathematics. During the course of the study, students in classes using Atomic Learning increased their SAT 10 Reading Comprehension scale-scores by 21 points (Mean pretest=667; Mean posttest score=686) and their mathematics scale-scores by 19 points (Mean pretest=668; Mean posttest score=689).

While the growth achieved by students using Atomic Learning is an important indicator of the effectiveness of Atomic Learning, a more complete way to assess growth is to compare the growth achieved by students in classes using Atomic Learning to students in classes that did not use Atomic Learning. This allows us to see the unique contribution Atomic Learning made to students' growth.

Comparison of Growth

The overall growth in Reading Comprehension and Mathematics skills as measured by the Reading Comprehension and Mathematics subtests of the SAT 10 for those students in the Treatment Group was compared to the Reading Comprehension and Mathematics subtests of those students in the Control Group. Multivariate Analysis of Covariance (MANCOVA) was used to evaluate the difference in a composite Reading Comprehension and Mathematics skill score (dependent variable) between the Treatment and Control Groups (independent variable) controlling for the initial Reading and Mathematics levels of the students (covariate).

The SAT 10 pretest scores were used as the covariate to place students in the Treatment Group and Control Group on the same baseline. The comparisons were based on 527 Treatment Group students and 208 Control Group students for whom both pretest measures and both posttest measures were available.

The results show a significant difference in a composite of the SAT 10 Reading Comprehension and Mathematics subtest posttest scores between the Treatment Group and the Control Group (df=2/730; F=12.01; $p<.01$) when initial Reading and Mathematics skills are controlled. Teachers use of Atomic Learning accounted for approximately 3% of the variation in a composite of the Reading Comprehension and Mathematics posttest scores. (Eta squared = .03).

3% of the growth in overall Reading and Mathematics skills can be explained by whether or not teachers used Atomic Learning

This means that about ***3% of the growth in overall Reading and Mathematics skills can be explained by whether or not teachers used Atomic Learning***. The results, using Pillai's Trace, are summarized in Table 5 below. (The results for Wilks Lamda and Hotelling's T are not reported since with only two groups the results are the same as those shown for Pillai's Trace.)

TABLE 5

Multivariate Analysis of Covariance Comparison of Treatment and Control Group Reading Comprehension and Math PostTest Scores

Effect		Value	F	Hypothesis df	Error df	Significance	Partial Eta Squared
Intercept	Pillai's Trace	.074	28.961	2	730	.01	.07
Reading PreTest	Pillai's Trace	.386	229.793	2	730	.01	.39
Matematics PreTest	Pillai's Trace	.535	420.082	2.000	730	.01	.54
Study Group	Pillai's Trace	.032	12.011	2.000	730	.01	.03

To provide a more complete understanding of these results for the separate Reading and Mathematics skill areas, the individual effects were examined separately using ANCOVA (See Table 6).

TABLE 6

Analysis of Covariance Comparison of the Treatment Group and Control Group Reading Comprehension and Mathematics PostTest Scores

Source	Dependent Variable	Type III Sum of Squares	df	Mean Square	F	Significance	Eta Squared
Corrected Model	Reading PostTest	952659.870[a]	3	317553.290	366.27	.01	.60
	Mathematics PostTest	1.383E6	3	460961.420	491.14	.01	.67
Intercept	Reading PostTest	45983.559	1	45983.559	53.04	.01	.07
	Mathematics PostTest	16181.086	1	16181.086	17.24	.01	.02
Reading PreTest	Reading PostTest	390209.889	1	390209.889	450.07	.01	.38
	Mathematics PostTest	7340.052	1	7340.052	7.82	.01	.01
Mathematics PreTest	Reading PostTest	50252.555	1	50252.555	57.96	.01	.07
	Mathematics PostTest	789462.570	1	789462.570	841.15	.01	.54
Study Group	Reading PostTest	17794.234	1	17794.234	20.52	.01	.03
	Mathematics PostTest	8770.932	1	8770.932	9.35	.01	.01
Error	Reading PostTest	633777.129	731	867.000			
	Mathematics PostTest	686083.850	731	938.555			
Total	Reading PostTest	3.455E8	735				
	Mathematics PostTest	3.493E8	735				
Corrected Total	Reading PostTest	1586436.999	734				
	Mathematics PostTest	2068968.109	734				

TABLE 7

Descriptive Statistics Comparison of the Treatment Group and Control Group Reading Comprehension and Mathematics PostTest Scores (Adjusted for PreTest Covariate)

Dependent Variable	STUDY Group	N	MEAN SAT 10	Standard Deviation SAT 10
Reading PostTest	Treatment	527	687.10	47.81
	Control	208	676.16	42.52
	Total	735	681.63	46.49
Mathematics PostTest	Treatment	527	689.46	54.82
	Control	208	681.79	48.27
	Total	735	685.63	53.09

Reading Comprehension Growth

The SAT 10 Reading Comprehension subtest scores, for those students in classes with teachers using Atomic Learning (Treatment Group) were compared to the SAT 10 Reading Comprehension subtest scores of those students in classes whose teachers did not use Atomic Learning (Control Group). ANCOVA was used to evaluate the difference in Reading subtest scores (dependent variable) between the Treatment and Control Groups (independent variable) controlling for the initial reading proficiency levels of the students (covariate). The SAT 10 pretest scores were used as the covariate to place students in the Treatment Group and the Control Group on the same baseline.

The results show a significant difference in Reading Comprehension between the Treatment Group and the Control Group (df=1/734; F=20.52; p<.01) when initial Reading proficiency is controlled. The average Reading Comprehension subtest score for students in the Treatment Group (Mean= 687.10) was significantly greater than the average Reading Comprehension subtest score achieved by students in the Control Group (Mean= 676.16). This represents an effect size of +.24 (Cohen's d). The results are summarized in Table 6 and 7 (see above).

Mathematics Growth

The SAT 10 Mathematics subtest scores, for those students in classes with teachers using Atomic Learning (Treatment Group) were compared to the SAT 10 Mathematics subtest scores of those students in classes whose teachers did not use Atomic Learning

(Control Group). ANCOVA was used to evaluate the difference in Mathematics subtest scores (dependent variable) between the Treatment and Control Groups (independent variable) controlling for the initial mathematics proficiency levels of the students (covariate). The SAT 10 pretest scores were used as the covariate to place students in the Treatment Group and the Control Group on the same baseline.

The results show a significant difference in Mathematics between the Treatment Group and the Control Group (df=1/734; F=9.35; p<.01) when initial Mathematics proficiency is controlled. The average Mathematics subtest score for students in the Treatment Group (Mean=689.46) was significantly greater than the average Mathematics subtest score achieved by students in the Control Group (Mean= 681.79). This represents an effect size of +.14 (Cohen's d). The results are summarized in Table 6 and 7 (see above).

GENDER RESULTS

We examined whether there were any differences in growth between male and female students between the Treatment and Control Groups (main and interaction effects). To this end, the overall growth in Reading and Mathematics skills for the Treatment Group was compared to the overall growth in Reading and Mathematics skills within the Control Group as measured by the SAT 10. MANCOVA was used to evaluate the difference in a composite reading and mathematics score (dependent variable) between the Treatment and Control Groups (independent variable) of different genders (independent variable) controlling for the initial skill levels of the students (covariate). The SAT 10 pretest scores were used as the covariate to place students in the Treatment Group and the Control Group on the same baseline.

The gender comparisons were based on 362 male students and 344 female students.

The main effect for study group memberships (Treatment and Control Group) was confirmed; there was a significant difference in a composite of the SAT 10 Reading Comprehension and Mathematics posttest scores between students in the Treatment and the Control Group when initial Reading and Mathematics proficiency levels are controlled (F=12.39; df=2/699 p<.01). Teachers use of Atomic Learning accounted for approximately 3% of the variation in a composite of the SAT 10 Reading Comprehension and Mathematics posttest scores overall (Eta squared=.03). There were no significant main effects for gender (F=1.25; df=2/699; p<.29) or the interaction between gender and study group membership (F=.17; df=2/699; p<.84). This indicates that teachers use of Atomic Learning was equally effective with boys and girls. The results, using Pillai's Trace, are summarized in Table 8 (see next page).

TABLE 8

Multivariate Analysis of Covariance
Comparison of Treatment and Control Group
by Gender and Reading and Math PostTest Scores

Effect		Value	F	Hypothesis df	Error df	Significance	Partial Eta Squared
Intercept	Pillai's Trace	.077	29.26	2.000	699.000	.01	.08
Reading PreTest	Pillai's Trace	.365	200.61	2.000	699.000	.01	.37
Matematics PreTest	Pillai's Trace	.524	385.03	2.000	699.000	.01	.52
Study Group	Pillai's Trace	.034	12.39	2.000	699.000	.01	.03
Gender	Pillai's Trace	.004	1.25	2.000	699.000	.29	.01
Study Group by Gender	Pillai's Trace	.000	.17	2.000	699.000	.84	.00

TABLE 9

Descriptive Statistics Comparison of the Treatment Group and Control Group
By Gender Reading Comprehension and Mathematics PostTest Scores
(Adjusted for PreTest Covariate)

Dependent Variable	Study Group	Gender	Mean SAT 10	Standard Deviation SAT 10	N
Reading PostTest	Treatment	Male	679.98	49.67	266
		Female	697.51	42.43	233
		Total	688.16	47.20	499
	Control	Male	679.66	40.93	96
		Female	676.69	44.16	111
		Total	678.07	42.61	207
	Total	Male	679.89	47.45	362
		Female	690.76	44.02	344
		Total	685.20	46.10	706
Mathematics PostTest	Treatment	Male	683.22	55.15	266
		Female	698.83	52.49	233
		Total	690.51	54.43	499
	Control	Male	683.88	52.10	96
		Female	682.75	44.32	111
		Total	683.28	47.97	207
	Total	Male	683.4033	54.28	362
		Female	693.6483	50.50	344
		Total	688.3952	52.68	706

ETHNICITY RESULTS

We examined whether there were any differences in growth between students in different ethnic groups between the Treatment and Control Groups (main and interaction effects). To this end, the overall growth in Reading and Mathematics skills for the Treatment Group was compared to the overall growth in Reading and Mathematics skills within the Control Group as measured by the SAT 10. MANCOVA was used to evaluate the difference in a composite reading and mathematics score (dependent variable) between the Treatment and Control Groups (independent variable) of different ethnicities (independent variable) controlling for the initial skill levels of the students (covariate). The SAT 10 pretest scores were used as the covariate to place students in the Treatment Group and the Control Group on the same baseline.

The ethnic comparisons were based on 583 Caucasian students and 111 Non-Caucasian students.

The main effect for study group memberships (Treatment and Control Group), was again confirmed; there was a significant difference in a composite of the SAT 10 Reading Comprehension and Mathematics posttest scores between students in the Treatment and the Control Group when initial Reading and Mathematics proficiency levels are controlled ($F=8.63$; $df=2/691$ $p<.01$).

Teachers' use of Atomic Learning accounted for approximately 3% of the variation in a composite of the SAT 10 Reading Comprehension and Mathematics posttest scores overall (Eta squared=.02). There were no significant main effects for ethnicity ($F=2.25$; $df=2/691$; $p<.11$) or the interaction between ethnicity and study group membership ($F=.64$; $df=2/691$; $p<.53$). This indicates that teachers' use of Atomic Learning was equally effective for students of different ethnic groups. The results, using Pillai's Trace, are summarized in Table 10 (see next page).

TABLE 10

Multivariate Analysis of Covariance
Comparison of Treatment and Control Group
by Ethnicity and Reading and Math PostTest Scores

Effect		Value	F	Hypothesis df	Error df	Significance	Partial Eta Squared
Intercept	Pillai's Trace	.078	29.13	2.000	691	.01	.078
Reading PreTest	Pillai's Trace	.367	199.89	2.000	691	.01	.367
Matematics PreTest	Pillai's Trace	.526	383.85	2.000	691	.01	.526
Study Group	Pillai's Trace	.024	8.63	2.000	691	.01	.02
Ethnicity	Pillai's Trace	.006	2.25	2.000	691	.11	.006
Study Group by Ethnicity	Pillai's Trace	.002	.634	2.000	691	.53	.002

TABLE 11

Descriptive Statistics Comparison of the Treatment Group and Control Group
By Ethnicity Reading Comprehension and Mathematics PostTest Scores
(Adjusted for PreTest Covariate)

Dependent Variable	STUDY Group	Ethncity	MEAN	Standard Deviation	N
Reading PostTest	Treatment	Caucasian	688.51	46.66	425
		Non-Caucasian	683.89	49.18	66
		Total	687.89	46.98	491
	Control	Caucasian	684.52	43.12	157
		Non-Caucasian	658.70	34.05	50
		Total	678.28	42.51	207
	Total	Caucasian	687.44	45.73	582
		Non-Caucasian	673.03	44.93	116
		Total	685.04	45.88	698
Mathematics PostTest	Treatment	Caucasian	690.70	55.13	425
		Non-Caucasian	690.15	50.88	66
		Total	690.62	54.53	491
	Control	Caucasian	690.68	47.54	157
		Non-Caucasian	659.30	42.70	50
		Total	683.10	48.24	207
	Total	Caucasian	690.69	53.15	582
		Non-Caucasian	676.85	49.76	116
		Total	688.39	52.82	698

During the 2010-2011 school year, SEG Measurement conducted a year-long, multi-site study with approximately 1,000 6th, 7th and 8th grade teachers and students in 42 classrooms in Minnesota, Missouri and Texas, to evaluate the impact of the Atomic Learning professional development solution on student achievement. Atomic Learning provides a portfolio of online tools to assist teachers in providing technology integrated instruction to foster student achievement and college and career readiness.

The goal of this study was to evaluate the impact of Atomic Learning's technology integration training on student learning. The results show that students in classes whose teachers use Atomic Learning learn significantly more than students in classes whose teachers do not use Atomic Learning.

Students in classes with teachers who were Atomic Learning users showed about a year more of growth in Language Arts and in Mathematics than students in classes with teachers that did not use Atomic Learning. The Atomic Learning-trained teachers made substantial use of technology in the delivery of instruction and provided assignments and projects that required students to integrate technology into their work.

Students in classes whose teachers use Atomic Learning ***learn significantly more*** *than students in classes whose teachers do not use Atomic Learning*

STUDY DESIGN

The primary question answered by this study is: Do students in grades 6, 7, and 8 show larger gains in Reading Comprehension and Mathematics skills if their teachers use Atomic Learning for professional development? The study also explored potential differences in growth between boys and girls and among students of different ethnic backgrounds.

The study compared two groups of teachers and students, matched in ability. The Treatment Group consisted of students in classes whose teachers used the Atomic Learning professional development solution; the Control Group consisted of students in classes whose teachers did not use Atomic Learning. The students in both groups were administered a pre-test at the beginning of the year and a post-test at the end of the year to evaluate the impact of teacher use of Atomic Learning on their Reading Comprehension and Mathematics growth.

The study compared the growth in Reading Comprehension and Mathematics Stanford 10 Achievement Test™ scores from the beginning of the school year to the end of the school year. The results from the pretest and posttest were compared statistically to determine the level of growth in Reading Comprehension and Mathematics skills.

IMPLEMENTATION

Teachers of students in the Treatment Group used Atomic Learning about one to two hours weekly, while teachers of students in the Control Group did not use Atomic Learning. Teachers using Atomic Learning reported a substantial increase in technology use and increased technology integration in the classroom. Several teachers reported an increased willingness to use technology in the classroom and several teachers integrated mobile devices such as iPads and iPods.

One school shifted from a model of offering specific classes in technology use to a broader integration of technology across all classes. To support broader student technology learning, students are required to present projects using multiple modes and are encouraged not to repeat use of the same medium for project presentations. This school also reported broader use of videoconferencing and Skype for teachers and students.

RESULTS

The Treatment Group students whose teachers used Atomic Learning showed substantial growth in Reading Comprehension and Mathematics during the course of the study. Students in classes using Atomic Learning increased their SAT 10 Reading Comprehension scale-scores by 19 points and their Mathematics scale-scores by 21 points. This means that the students in the Treatment Group, on average, achieved about two years of growth (for the typical student at the 50th percentile), during the year in which the study was conducted. These estimates are based on the average gains seen by students at the 50th percentile at grades 6, 7 and 8 provided by Harcourt (2002).

The greater academic growth observed for students in Atomic Learning classes becomes even more visible when comparing these students against the Control Group, whose teachers did not use Atomic Learning. Students in the Treatment Group showed statistically greater gains in both Reading Comprehension and Mathematics than the Control Group. The Treatment Group students showed substantially greater gains in Reading Comprehension (11 scale score points; Effect Size= .24) and Mathematics (7 scale score points; Effect Size=.14) than the Control Group classes.

This means that, on average, students in the Treatment Group showed about a year's more growth than their peers in classes where Atomic Learning was not used. Again, these estimates are based on the average gains seen by students at the 50th percentile at grades 6, 7 and 8 provided by Harcourt (2002).

These effects suggest that the use of Atomic Learning has a substantial impact on student Reading Comprehension and Mathematics skills growth. The solution was found to be equally effective for boys and girls and for students of different ethnicities.

For comparison, the effect size for Reading Comprehension is above the typical effect sizes seen in other studies of instructional programs. Mathematics was more typical of the comparative gains seen in other studies of instructional programs. (For example, Slavin (2008) in his comprehensive synthesis of middle and high school Reading program research studies reports a mean effect size for instructional-process Reading programs of +.21.)

We also examined the impact of teachers' use of Atomic Learning on both boys and girls and among students of different ethnic backgrounds to determine if the solution was differentially effective for major groups within the population. The solution was found to be equally effective for boys and girls and for students of different ethnicities. In short, the interaction between Atomic Learning professional development solution use and gender and ethnicity was not statistically significant.

The use of

Atomic Learning has a substantial impact on student

Reading Comprehension and Mathematics

skills growth

SUMMARY

Students who were in classes whose teachers used Atomic Learning showed substantial growth in Reading Comprehension and more moderate gains in Mathematics during the course of the study. Students in Treatment Group classes increased their SAT 10 scores between 19 and 21 points, or about two years' worth of growth. More significantly, Treatment Group students enrolled in classrooms whose teachers used Atomic Learning showed about a year's more of growth in Reading Comprehension and Mathematics than the Control Group students enrolled in classes where teachers did not use Atomic Learning. The Atomic Learning professional development solution users finished the year with scores that were 11 scale-score points higher in Reading Comprehension and 7 scale-score points higher in Mathematics on the SAT 10 assessments. The study also found that Atomic Learning is equally effective for boys and girls and for students of different ethnic backgrounds.

The findings of this study provide substantial support for the effectiveness of Atomic Learning in improving student Reading Comprehension and Mathematics skills.

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