The Influence of Using *Adaptive Curriculum* on the Math Achievement of Sixth and Seventh Graders

Research Report
for Arizona State University's
Middle School Math

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ABSTRACT

The influence of using Adaptive Curriculum on the math achievement of sixth, seventh, and eighth grade students was investigated with several Title 1 schools in a Southwest school district. The results support the integration of Adaptive Curriculum into existing math curricula as using Adaptive Curriculum was associated with an increase in the math achievement of students in all three middle school grades.

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INTRODUCTION

An evaluation of Adaptive Curriculum was conducted with a sample of students from several middle schools from a school district in the Southwest. The evaluation compared the achievement of sixth and seventh graders on a math test after using Adaptive Curriculum in comparison to a group of students at another school in the same district. In addition, the achievement of eighth graders using Adaptive Curriculum was examined.

METHOD

Participants

The sample consisted of students from four Title 1 schools in a medium sized urban school district in the Southwest with 96 percent of the student population being of a Hispanic origin. Ninety percent of the students in the school district were eligible to receive free or subsidized lunches. Data was received from 1,320 students. However, due to a computer error, much of the data was invalid and returned students' scores as "0." Moreover, some students only completed either the pre-test or the post-test, but not both. Students were only included in the analyses if they completed both the pre-test and post-test with a score of "0" treated as missing (see Table 1). The treatment group included the three schools with the highest percentages of students eligible for free or subsidized lunches. The comparison group consisted of students from another middle school in the same district that had a similar percentage of students eligible for free or subsidized lunches. Data from the school used as the comparison group was only received from students in the sixth and seventh grades.

The students from the three schools with the highest percentage of students eligible for free or subsidized lunches were assigned to the treatment group. A fourth school in the same district that opted not to use Adaptive Curriculum was assigned to the comparison group. All classes in schools that were a part of the treatment group were given access to Adaptive Curriculum.

Table 1: Number of Participants

	6th Grade	*7th Grade*	*8th Grade*	*Total*
Treatment Group	148	169	N/A	317
Comparison Group	193	125	85	403
Total	341	294	85	720

Procedure

The students from the three schools with the highest percentage of students eligible for free or subsidized lunches were assigned to the treatment group. A fourth school in the same district that opted not to use Adaptive Curriculum was assigned to the comparison group. All classes in schools that were a part of the treatment group were given access to Adaptive Curriculum. Classes in the treatment group were expected to use two to three lessons (for about 20 to 30 minutes per lesson) from Adaptive Curriculum every two weeks. Teachers may incorporate Adaptive Curriculum into their instructional approach in several ways. Teachers could present an Adaptive Curriculum lesson to the entire class using a projector or an interactive whiteboard, or assign Activity Objects to individual students or small groups of students.

Measures

A 20 item math test was administered over the Internet or in a paper-and-pencil format that was designed based on Arizona's Instrument to Measure Standards (AIMS). AIMS is a standardized test administered by the state of Arizona as part of the state-wide assessment system to maintain compliance with the No Child Left Behind Act. One test was created for each grade level: sixth grade, seventh grade, and eighth grade.

RESULTS

Table 2 and Table 3 display the descriptive statistics for the treatment and comparison groups on the pre- and post-tests for the students in sixth and seventh grade. Figure 1 and Figure 2 provide a graphical representation of the average math achievement attained by the treatment and comparison groups on the pre- and post-tests.

A 20 item math test was administered over the Internet or in a paper-and-pencil format that was designed based on Arizona's Instrument to Measure Standards (AIMS).

Table 2: Descriptive Statistics on Pre- and Post-tests for Sixth Grade

	Pre-test		Post-test	
	Mean	SD	Mean	SD
Treatment Group	7.9	3.5	10.4	3.6
Comparison Group	8.4	3.4	8.9	3.7

Table 3. Descriptive Statistics on Pre- and Post-tests for Seventh Grade

	Pre-test		Post-test	
	Mean	SD	Mean	SD
Treatment Group	6.1	2.4	9.3	3.4
Comparison Group	8.5	3.4	9.9	3.7

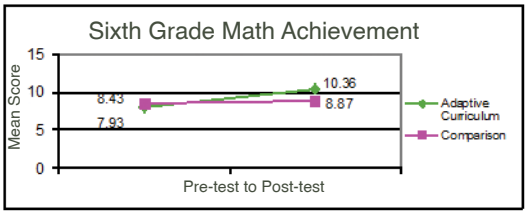

Figure 1. Group Comparison in Math Achievement for Sixth Grade.

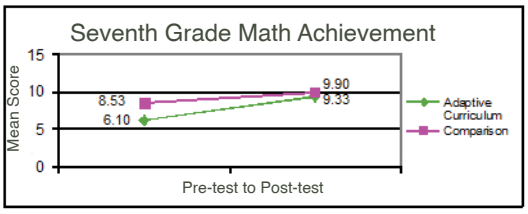

Figure 2. Group Comparison in Math Achievement for Seventh Grade.

ANOVAs and ANCOVAs are commonly used to test whether there is a statistical difference between two or more means, and may be used to answer the following question: Did a group of students from one school that received an intervention perform significantly better on a math assessment than a group of students from another school that did not receive the intervention?

Hays, W. L. (1994). Statistics (5th Ed.). For Worth: Harcourt College Publishers.

Several ANOVAs were computed to determine whether there was a significant difference between the treatment group and the comparison group on the pre- and post-tests. The findings indicate that the sixth graders' scores from the treatment group were not significantly different from the comparison group on the pre-test, $F(1, 339) = 1.77$, *ns*, $\eta_p^2 = 0.01$. Another ANOVA was computed to examine the difference between the treatment and control groups on the post-test. The results indicate that the treatment group scored significantly higher on the post-test than the comparison group, $F(1, 339) = 14.01$, $p < .05$, $\eta_p^2 = 0.04$. Cohen's d indicates that the difference may be characterized as a small effect ($d = .41$). Cohen's d was also used to examined the pre-test/post-test difference, and based on the result for the treatment group the effect size may be classified as a medium effect ($d = .76$) and for the comparison group the value indicates that there is not a significant effect ($d = .13$).

The seventh graders from the treatment group scored significantly lower than the comparison group on the pre-test, $F(1, 292) = 47.38$, $p < .05$, $\eta_p^2 = 0.14$. As there were pre-test score differences, an ANCOVA was computed with the pre-test score entered as a covariate. The ANCOVA results do not indicate a significant difference on the post-test, $F(1, 291) = 1.73$, *ns*, $\eta_p^2 = 0.01$. Cohen's d was used to compute the effect size of the pre-test/post-test score differences. Cohen's d for the treatment group indicates that a large effect size was present ($d = .94$), and for the comparison group that a small to medium effect was present ($d = .37$).

Table 4 displays the descriptive statistics for the eighth graders in the treatment group as no data was received from eighth graders in the comparison group. A repeated measures ANOVA was computed entering the pre-test scores and post-test scores as dependent variables. The results indicate that the treatment group's post-test score, on average, improved from the pre-test score, $F(1, 84) = 4.70$, $p < .05$, $\eta_p^2 = 0.05$. The effect size calculation indicates that the change may be considered a small effect ($d = .24$).

Table 4. Descriptive Statistics on Pre- and Post-tests for Eighth Grade

	Pre-test		Post-test	
	Mean	SD	Mean	SD
Treatment Group	6.3	2.1	7.0	2.3

DISCUSSION

The results from all three grade levels support the use of Adaptive Curriculum. The results from the sixth graders provide the strongest supporting evidence. On the pre-test, the Adaptive Curriculum sixth graders' scores were not significantly different from the comparison group, and on the post-test, the Adaptive Curriculum sixth graders' scores were significantly higher than the scores from the comparison group. The increase may be considered at the level of a medium effect. Although the Adaptive Curriculum seventh graders' scores were lower than the comparison group on the pre-test, there was no difference between either groups' scores on the post-test. The findings from the seventh graders demonstrates that although the students in the treatment group scored lower on the pre-test, they closed the gap on the post-test after using Adaptive Curriculum. The pre-test/post-test difference for the Adaptive Curriculum seventh graders may be classified as a large effect, and for the comparison group as a small effect. Finally, the results indicate that the eighth graders using Adaptive Curriculum improved from the pre-test to the post-test.

The results from all three grades level support the use of Adaptive Curriculum in middle school to enhance math curricula. Adaptive Curriculum was associated with an increase in the math achievement of the middle school students in sixth, seventh, and eighth grade.

ABOUT AUTHOR

Dr. Gary Bitter is a Professor of Educational Technology in the Mary Lou Fulton Teachers College at Arizona State University and Executive Director of Technology Based Learning & Research (TBLR). He has received lifetime achievement awards from the International Society for Technology in Education (ISTE) and the National Council of Teachers of Mathematics (NCTM) as well as outstanding alumnus awards from Kansas State University and Emporia State University. His groundbreaking research and development of digital curricula and professional development materials is poised to transform PreK-16 and adult learning environments.

Gary was the co-director of the International Society for Technology in Education (ISTE) National Educational Technology Standards (NETS) Project. The NETS Project developed National Standards for Students and Teachers. More than 40 states including Arizona use some form of these technology standards. As the founding board member and first-elected president of ISTE, he helped to redefine the boundaries of the PreK-12 classrooms by forming a network of dedicated professionals sharing classroom-proven solutions to address the challenge of infusing technologies across the curriculum. Bitter earned his Ph.D. in Mathematics and Computer Education at the University of Denver.