

## Abstract Body

### Background / Context: Context

Algebra has been, and continues to be, a significant factor in students' success at the secondary and post-secondary levels. In a 2013 report from the National Center for Education Statistics (NCES), the data collected from the National Assessment for Educational Progress (NAEP) indicated that students who took a rigorous Algebra course scored on average at least 9 points higher on the NAEP than students who enrolled in a beginner algebra course.

The National Math Panel report (2008) used research findings across multiple studies to support the need for substantive learning relative to algebraic concepts in early grades. Throughout the elementary and middle school grades, children should be developing algebraic concepts that support further acquisition of algebraic skills and a more formal approach to algebra. There is a critical need to ensure middle students with mathematics difficulties are better prepared for Algebra I and II high school courses. Algebra-readiness concepts and skills must be mastered in the middle grades at the very latest. Thus, the purpose of this study was to conduct an efficacy study of a 7<sup>th</sup> grade Integers module designed for mathematics interventionist teachers to deliver to Tier 2 students with mathematics difficulties (as determined by performance on the previous year's high stakes mathematics test).

### Purpose / Objective / Research Question / Focus of Study:

The purpose of this study is to report results for one module, Integers, based on an efficacy study conducted with 7<sup>th</sup> grade students administered by mathematics interventionist teachers. Two research questions guided this study.

1. What are the effects of Project AIM2 Integers module on 7<sup>th</sup> grade Tier 2 student performance on a proximal measure (*easycbm*) compared to the "business as usual" condition of 7<sup>th</sup> grade Tier 2 student performance on the *easycbm*?
2. What are the effects of Project AIM2 Integers module on 7<sup>th</sup> grade Tier 2 student performance on a distal measure (*GMADE*) compared to the "business as usual" condition of 7<sup>th</sup> grade Tier 2 student performance on the *GMADE*?

### Setting:

This study occurred in 16 middle schools in six cities in Central and North Texas. Trained district interventionists from the research group delivered the intervention to both treatment students and control students who agreed to participate in this study and whose parents/guardians provided written consent in accordance with the University's Internal Review Board's procedures.

### Population / Participants / Subjects:

A total of 380 students participated in the current study (210 treatment, 170 control). Demographic characteristics for each group are presented in Table 1. Twenty-four mathematics interventionists administered the lessons to the students. Demographic characteristics for the teachers are presented in Table 2. Students were identified in the district as struggling in mathematics, primarily based on their poor performance on the previous year's high stakes mathematics test.

### Intervention / Program / Practice:

A fully developed Tier 2 Algebra-readiness Intervention Integers Module, which had been developed and field tested during an IES-sponsored Goal 2 grant, Project AIM, for students with mathematics difficulties has a net positive impact on the mathematics achievement of seventh grade students with mathematics difficulties in comparison to the “business as usual” group of seventh grade students with mathematics difficulties. The overall goal of the Integers module was to develop students’ ability to access more formal algebraic concepts and skills

### **Research Design:**

The research design was a pretest-posttest control group design. Students in intervention classes were randomly assigned to a treatment or comparison group at the beginning of the school year. A high quality randomized controlled trials (RCT) experimental design was selected to meet the IES What Works Clearinghouse criteria (WWC Procedures and Standards Handbook, 2013) and examine the effectiveness of an intervention.

### **Data Collection and Analysis:**

**Data Collection:** For the first research question, the *easycbm* (The University of Oregon, 2008) Mathematics Algebra test was used as the proximal measure for the Integers module. The *easycbm* authors (See Anderson et al., 2014) have considerable evidence, given their national norming process, concerning the measure's technical adequacy.

The *Group Mathematics Assessment and Diagnostic Evaluation* (GMADE; Pearson, 2004) served as the outcome, distal measure to address the second research question. GMADE Level M was used for grade 7; two subtests (Operations and Computation and Process and Applications) were administered to participating students, and, as directed in the test’s technical manual, raw scores from the two subtests were summed combined to form a composite Total Mathematics score. A pretest (Form A) was administered in the fall of the academic year of the project, and a posttest (Form B) was given at the end of the research. The GMADE technical manual reports considerable information supporting the reliability of each measure (all coefficients exceed .80) and the validity of the test’s scores (content, concurrent and predictive, construct).

**Analysis:** ANCOVA was used to evaluate group differences obtained on the posttest at the end of the intervention and Benjamani-Hochberg was applied to control for Type 1 error rate. Pretest scores were used as covariates.

### **Findings / Results:**

For research question 1, the treatment group outperformed the comparison on the *easycbm* total score. The differences were statistically significant ( $p=.002$ ). The Benjamani-Hochberg procedure did not alter the pattern of significant findings. Means and standard deviations are provided for the posttest (M, SD) along with  $f$  and  $p$  values, and the effect size (Hedges  $g$ ) in Table 3.

Findings for the second research question were less favorable. No significant differences were found between groups for the distal measure (GMADE). Means and standard deviations are provided for the posttest (M, SD) along with  $f$  and  $p$  values, and the effect size (Hedges  $g$ ) in Table 3.

### **Conclusions:**

Findings revealed that students in the treatment condition demonstrated statistically significantly higher scores than comparison students on the *easycbm* Total Score (proximal

measure). We were disappointed but not surprised with the findings on the outcome (distal) measure. Certainly, future research should focus on how enhancements in algebra can translate to improved performance in other mathematical areas.

## **Appendix A. References**

*References are to be in APA version 6 format.*

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## Appendix B. Tables and Figures

*Not included in page count.*

Table 1

*Demographic Characteristics of the Student Sample Post-Attrition*

	Treatment	Comparison
Total:	210	170
Gender		
Female	45%	48%
Male	55%	52%
Ethnicity		
Asian/Pacific Islander	2%	2%
African-American	12%	14%
Hispanic	66%	67%
Euro-American	15%	14%
Mixed	5%	3%
English Language Learners (ELL)	23%	24%
Free/Reduced Lunch	68%	72%

Table 2  
*Demographic Characteristics of the Teacher Sample*

Category	Percent
Gender	
Female	50%
Male	50%
Ethnicity	
African-American	21%
Hispanic	30%
Euro-American	38%
Mixed	12%
Age	
18-25	8%
26-33	42%
34-41	25%
42-49	8%
50+	17%
Years Teaching	
0-5	38%
6-10	38%
11-15	17%
16-20	4%
20+	4%
Highest Degree	
Bachelors	46%
Masters	54%
Certification	
Special Education	8%
General Education	79%
Mathematics	13%

Table 3  
*Comparison of Treatment and Comparison Groups*

Measure	Group	Posttest M	Posttest SD	f	p	Hedges g
<i>easycbm</i>	Treatment	11.77	3.75	14.11	.000	.32
	Control	10.48	4.31			
GMADE	Treatment	18.24	5.63	2.45	.119	.08
	Control	17.79	6.21			