

CURRICULUM IMPLEMENTATION: A STUDY OF THE EFFECT OF A  
SPECIALIZED CURRICULUM ON SIXTH GRADE MATHEMATICS SUMMATIVE  
TEST SCORES IN A RURAL MIDDLE SCHOOL

A Dissertation

Presented to

The Faculty of the School of Education

Liberty University

In Partial Fulfillment

of the Requirements for the Degree

Doctor of Education

by

Libby Plath Bicknell

May 2009

Curriculum Implementation: A Study of the Effect of a Specialized Curriculum  
on Sixth Grade Mathematics Summative Test Scores in a Rural Middle School

by Libby Plath Bicknell

APPROVED:

COMMITTEE CHAIR

Scott B. Watson, Ph.D.

COMMITTEE MEMBERS

Gregg Mowen, Ed.D

Lisa Schlabra, Ed.D

CHAIR, GRADUATE STUDIES

Scott B. Watson, Ph.D

### Abstract

Libby Plath Bicknell. CURRICULUM IMPLEMENTATION: A STUDY OF THE EFFECT OF A SPECIALIZED CURRICULUM ON SIXTH GRADE MATHEMATICS SUMMATIVE TEST SCORES IN A RURAL MIDDLE SCHOOL. (Under the direction of Dr. Scott Watson) School of Education, May 2009.

The purpose of this study was to examine curriculum implementation in sixth grade mathematics as it related to standardized testing in a rural district. The school in the study contained two groups of students, one group who had been taught the new state-mandated curriculum and another group who was taught an outdated curriculum. The purpose was to determine if there was a statistically significant disparity between the criterion-reference test scores of the two groups while controlling for differences in student ability level through the use of pre-test scores as measured through an analysis of covariance (ANCOVA). The hypothesis was that no difference would exist between the scores of the two groups. The hypothesis was rejected, as the difference between the two groups was statistically significant.

© Copyright 2009 by Libby Plath Bicknell (Ed.D.)

All Rights Reserved

## Acknowledgements

I would like to thank all of the teachers I have had throughout my life that have inspired me and encouraged me to always put forth my best effort. Your support, encouragement, and passion have shaped who I am today.

Thank you to Dr. Scott Watson, my committee chair, for helping me throughout this process. You have been very supportive and have helped make this a very memorable, meaningful experience. My thanks also go to my committee members, Dr. Lisa Schlabra and Dr. Gregg Mowen. Lisa, your friendship has been invaluable to me through the years. Thank you for encouraging me to finish my education. Dr. Mowen, your expertise and guidance has been so helpful.

My dear friend, Faith, thank you for always sticking by me and working side-by-side with me throughout this degree. I could not have done it without you.

Thank you to my mom, Dr. Robin Norsworthy, for the encouragement and support throughout my education. You have been a great source of strength for me.

### Dedication

I want to dedicate this work to my family: Greg, my wonderful husband and best friend; Will, my patient and loving little boy; and Alyssa, whom I have carried in my womb for all of my dissertation writing. You are all my inspiration and my strength. You have been so patient and have provided so much love and encouragement for me. Thank you!

## TABLE OF CONTENTS

	Page
Abstract.....	iii
Copyright .....	iv
Acknowledgements .....	v
Dedication.....	vi
Table of Contents .....	vii
List of Tables .....	x
List of Figures.....	xi
 CHAPTER ONE: THE PROBLEM	
Introduction .....	1
Statement of the Problem .....	5
Purpose.....	10
Research Question .....	15
Hypothesis.....	16
Definition of Key Terms.....	16
The Study .....	18
 CHAPTER TWO: LITERATURE REVIEW	
Introduction .....	19
Historical Background .....	19
Theoretical Background/Theoretical Framework.....	22
Related Research .....	23

Curriculum .....	23
Performance-Based Standards .....	25
Textbooks .....	27
Previous Courses Completed in Mathematics .....	27
Instruction .....	29
Mathematics Teachers .....	34
Assessment.....	36
Standardized Testing .....	37
Professional Development for Teachers.....	41
Instructional Leadership .....	46
Change Implementation in Schools.....	49
The Literature as It Relates to This Study.....	50
Summary .....	51
 CHAPTER THREE: METHODOLOGY	
Overview of the Study .....	52
Design of the Study.....	54
Research Participants .....	54
Data Gathering Methods .....	57
Instrumentation .....	59
Sampling Procedures .....	60
Data Analysis Procedures.....	60
Summary .....	62



## CHAPTER FOUR: FINDINGS

Purpose of the Study .....	63
Interview and Document Review .....	65
The Data .....	67
Summary .....	74

## CHAPTER FIVE: SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

Summary .....	76
Introduction.....	76
Purpose .....	77
Participants.....	78
Methods .....	78
Results of Research Question .....	79
Hypothesis .....	81
Discussion .....	81
Conclusion.....	86
Implications for Practice .....	87
Limitations .....	91
Recommendations.....	94
Recommendations for Future Research .....	96
Summary .....	97
References.....	99

## List of Tables

	Page
Table 1.	Table 3.1: Ethnicity ..... 55
Table 2.	Table 3.2: Demographic Information..... 56
Table 3.	Table 4.1: Scale Score Ranges for the CRCT..... 68
Table 4.	Table 4.2: Summary Statistics ..... 69
Table 5.	Table 4.3: Results of Analysis of Covariance (ANCOVA)..... 70
Table 6.	Table 4.4: Adjusted Post-Test Scores..... 71
Table 7.	Table 4.5: Summary Statistics Excluding Students Gifted in Math..... 72
Table 8.	Table 4.6: Results of Analysis of Covariance (ANCOVA) Excluding Students Gifted in Math..... 73
Table 9.	Table 4.7: Adjusted Post Test Scores Excluding Students Gifted in Math ..... 74

## List of Figures

	Page
<i>Figure 1.</i>	Figure 1.1: School/State Comparison of 6 <sup>th</sup> Grade Math Scores ..... 8
<i>Figure 2.</i>	Figure 1.2: CRCT Scores for Cohort Group of Students ..... 9
<i>Figure 3.</i>	Figure 1.3: Ethnic Breakdown of School Population..... 13
<i>Figure 4.</i>	Figure 4.1: Student Performance Levels on CRCT for Control Group..... 64
<i>Figure 5.</i>	Figure 4.2: Student Performance Levels on CRCT for Treatment Group. 64

## CHAPTER ONE: THE PROBLEM

### Introduction

From the earliest years in American history, education has been viewed as a tool for prosperity, though originally parents were responsible for teaching their own children. Government first became involved in educational legislation in 1642 when Massachusetts passed a law requiring that parents teach their children about religion and state laws. Five years later, each town was required by law to hire a teacher to teach the town's children reading and writing and prepare them to attend college (Sass, 2008). At this point, government-sponsored public education in the United States was born.

States are given the authority to provide education for their citizens under the Tenth Amendment of the U.S. Constitution that states, "The powers not delegated to the United States by the Constitution, nor prohibited by it to the States, are reserved to the States respectively, or to the people" (FindLaw, n.d.). In 1852, Massachusetts was the first state to pass laws requiring school attendance for elementary-age students, and many states followed their example. Currently, all 50 states require a free public education for all of their children with compulsory attendance laws to enforce it (National Center for School Engagement, n.d).

While state governments maintain control over the public school systems in their state and local governments actually run the schools, the federal government has begun to become very involved. Though the federal government has no official power over state schools, they can offer funding to school systems with stipulations that must be followed to receive funding. At the present time, school systems depend on the federal

government for approximately 9% of their operating budgets (U.S. Department of Education, 2008). Because systems have relied on this money as an integral part of their budgets, they are at the mercy of the federal government and its initiatives.

This federal involvement in educational legislation and funding began with a concern for equality for all students and anxiety about the ability of America to compete internationally. The Smith-Hughes Act in 1917 was passed in an attempt to add vocational training to schools that previously had focused only on preparing students for college. When Sputnik was launched in 1958 by the Soviet Union, the government became apprehensive that U.S. schools could not compete internationally. They enacted The National Defense Education Act (NDEA) to increase rigor in science, math, and foreign language education (United States Department of Education, 2008). While these acts did affect education, they were not nearly as intrusive as the Civil Rights legislation that would follow over the next 50 years.

Education was a major focus of the Civil Rights Movement during the 1950's and 1960's. Through the series of court cases and legislation that followed, such as *Brown v. Board of Education of Topeka, Kansas*, which called for an end to racial segregation in schools in the 1950's (Cozzens, 1998), and the Civil Rights Act of 1964, which barred discrimination in all public places, the federal government began to take a more vested interest in public schools (CivilRights.org, n.d.).

During the Civil Rights Movement, poverty was addressed by the federal government through the passing of the Elementary and Secondary School Act of 1965. This legislation, also known as Title I, provided a large amount of funding for schools that serve students who are considered economically disadvantaged (Schugurensky,

2002). Title I currently allows the federal government to control actions of many schools due to the large amount of funding provided to schools that comply and are accountable for these students. While the federal government does not specify how the money should be spent by the local school system, they do provide and enforce strict guidelines for schools to participate in their programs and receive federal dollars.

Along with the push for racial and economic equality in schooling, there was also a desire to make opportunities more equitable for female students. The federal government, with the purpose of ensuring that female students have the same rights and educational opportunities as male students, enacted title IX. While this mainly affected athletic programs, Title IX is still debated in regards to same-gender schools and placement of students in advanced math and science classes. School systems refusing to comply with Title IX risk losing all federal funding (Imbornoni, 2007).

Once the federal government succeeded in equalizing opportunities in education for minority and female students, the focus turned to students with disabilities. To address the need for education of these students, Congress created Public Law 94-142 in 1975, known as the Individuals with Disabilities Education Act, or IDEA. The addition of IDEA forced schools to create special education programs to address the needs of students who previously were not allowed to attend public schools. These students became protected under compulsory attendance laws, and schools were responsible for providing appropriate services to allow them equal access to education. Congress re-authorized the law and amended it in 1997 to call for not just equal access but improvement in results for students with disabilities (United States Department of Education, 2007).

Currently, talk in education and politics is riddled with discussions of accountability for all students in regards to ethnicity, disability, and economic status. No Child Left Behind (NCLB), enacted in 2001, is a reauthorization of an amendment to the Elementary and Secondary Education Act of 1965. It has great implications for school funding for any state or school system not in compliance. NCLB requires states to set standards and accountability measures for schools to ensure the success of all students as a whole and in subgroups by ethnicity, disability, and economic status. Schools are required to show Adequate Yearly Progress (AYP) for all groups of students or risk sanctions and/or a loss of funding by government entities (United States Department of Education, 2004). This call for accountability forced many schools to shift their focus from educating children to ensuring that their students pass a high-stakes standardized test each year to show improvement. Nichols and Berliner (2005) state that the goal of NCLB is to use results of a test to force changes in habits of teachers, students, and school leadership.

Because of the immense pressure placed on schools to make AYP and avoid being labeled as needing improvement, the taught curriculum is increasingly test-driven, leaving little time for activities that make learning fun for students. Assessment is critical in schools to determine whether or not students are learning the appropriate content; however, the assessment used should reflect what is being taught and should give students the opportunity to demonstrate their mastery in a non-threatening manner. The goal for assessment should be assessment for learning and not assessment of learning. Popham (2001) suggests that standardized test items undergo more rigorous review processes in which appropriateness of content and possible bias are fully explored. This

would give criterion-referenced tests more validity and allow educators to truly use the information to improve instruction within schools. Without this, it is difficult to use student data from the tests because there is no assurance that the results are reflective of students' mastery of curricular requirements.

At the same time that accountability is increasing, states are examining their mandated curriculum and altering them in an attempt to graduate students who can compete for jobs on a global level. The problem, however, is that states are forcing curricular changes on schools and assessing the students on the new standards in the same year, regardless of any gaps in knowledge experienced through the change. Ralph Tyler, in his book, *Basic Principles of Curriculum and Instruction* (1949), suggests that change in education is accepted slowly and often takes a long time to show effects; therefore, curriculum implementation should be carefully planned with long-term outcome goals. He also states that meaningful educational experiences are built on prior knowledge and are sequential to allow the learner to make connections, resulting in retention of new concepts (Tyler, 1949). Glatthorn (1994) also states that long-term goal setting, including consideration of textbook adoption cycles, is critical to the success of any new curricular change. While the ideas of increased rigor in curriculum and greater accountability for schools for all children are noble, more strategic planning should take place to ensure the change is positive and lasting.

#### Statement of the Problem

In the state of Georgia, achievement of AYP depends on student test scores on an end-of-year criterion-referenced test and one other indicator (typically attendance or graduation rate). With the mounting pressure on schools, teachers are desperate to find



ways to raise test scores. Popham (2001) believes that the push for higher standardized test scores in schools is resulting in many problems, including teacher cheating and an abandonment of sound instructional practices, resulting in a test-driven curriculum.

This study will examine the relationship between the state-mandated curriculum in the state of Georgia and the accompanying high-stakes, standardized criterion-referenced test used to judge whether or not that curriculum was implemented. Quality instruction based on state standards is believed to be necessary for student success on high-stakes criterion referenced tests. When students are not taught the appropriate curriculum, their test scores should reflect this lack of information, as long as the test is truly reflective of the content in the corresponding curriculum.

Prior to the 2005-2006 school year, the school in this study failed to make AYP for seven years and was facing a bleak future with a possible take-over by the state department of education. Teachers were frustrated, but they continued to work daily to achieve the goals set by the state. During the 2005-2006 school year, the state began a new math curriculum, further compounding the teacher's apprehension about the school's future.

The rural middle school in this study was required by the state department of education to implement the new math standards beginning in the 2005-2006 school year, beginning with sixth grade. One sixth grade math teacher was sent to the state training to learn how to teach the standards and was expected to train the other two sixth grade math teachers on the new methods and content when she returned, the "train the trainer" model used to reduce costs. As she attempted to provide the training for the other two teachers, she was met with resistance, and she ultimately closed her classroom door and taught the

new standards, leaving the other two teachers to continue teaching the old standards. When questioned later about their practices in the classroom, the two teachers who refused to teach the new standards stated that they intentionally made this choice because they were confident that the state department would not be able to create a test based on the new standards by that spring. The criterion-referenced test given in the fall appeared to be correlated to the new standards, and the student math scores seemed to reflect the teaching practices. The number of students meeting standards on the test fell drastically across the grade level and across the entire state in comparison to performance on the test the previous year. Despite poor scores overall, the students taught by the teacher who embraced the new curriculum seemed to perform better on the test than the students taught by the other two teachers.

The students who were denied the new curriculum in sixth grade essentially entered seventh grade an entire school year behind in math. The seventh grade math teachers incorporated the sixth grade standards as much as they could into their teaching, while the school administration hired tutors to help these students in small groups. Much of this targeted assistance continued through these students' eighth grade year as well. They are now entering high school and still have not been able to recover. Math scores remain abysmal for this entire grade level, though it is unclear at this time whether or not the difference between the two groups of students when they were in sixth grade was significant enough to have impacted their future performance. This study will attempt to show the significance of the difference when students were taught the state-mandated curriculum in comparison to not receiving the appropriate content.

The school, at the end of the 2005-2006 school year, made AYP for the first time

in seven years despite the poor sixth grade math scores. The school continued to make AYP, allowing them to be removed from the state needs improvement list. However, these students continued to struggle, and their scores reflected the gaps in their knowledge. When the group of students, particularly those in special education, in this study was in eighth grade, their scores were abysmal in math, resulting in the school not making AYP. At this time, the school administrators are trying desperately to identify what went wrong with this group to prevent this from happening again with a future cohort.

Figure 1.1

*School/State Comparison of 6<sup>th</sup> Grade Math Scores*

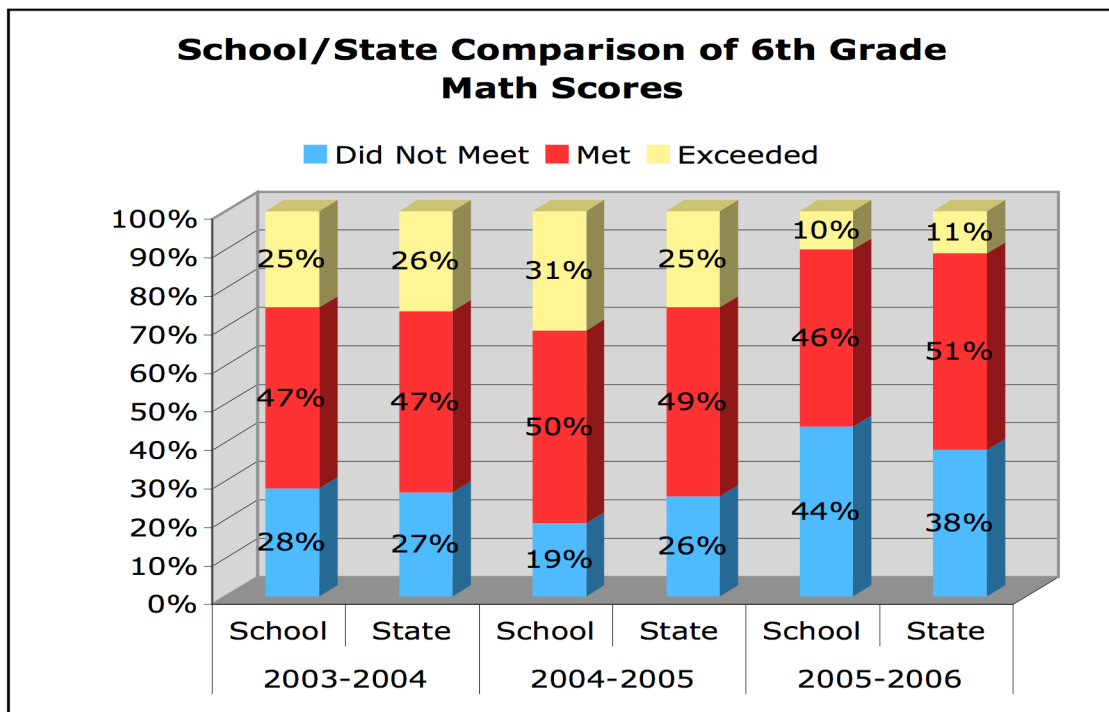


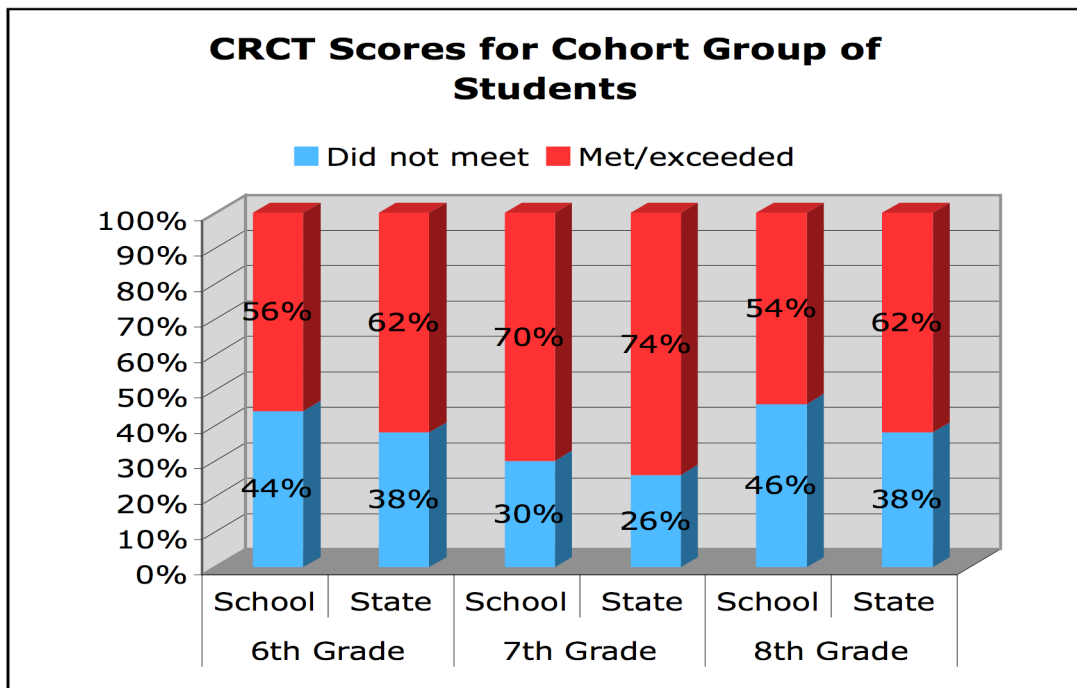
Figure 1.1 shows how 6<sup>th</sup> grade groups in the school system performed for three years on the math CRCT in comparison to the state scores. The discrepancy between the school and state scores for the 2005-2006 school year sparked the

researcher’s interest in pursuing this study. Important to note was the large drop in state scores in the same year; this was the year of the new math curriculum for all schools in the state. While all scores dropped across the state, the school was greatly concerned that the scores of their students were remarkably lower than the state average.

The study is being conducted three years later, once the problem has compounded, resulting in abysmal scores for an eighth grade class in a state in which students must pass the eighth grade CRCT to be promoted to high school. The cost to the

Figure 1.2

*CRCT Scores for Cohort Group of Students*



system to remediate all of these students in summer school and provide a re-test opportunity was high, and most of the students still could not perform at the appropriate level on the re-test. Figure 1.2 shows the progression of the group of students in comparison to the state as they moved from grade to grade in middle school. While

Figure 1.1 originally caused alarm for the school administrators, teachers, and parents, Figure 1.2 shows the need for this study to determine what happened in the original year of curriculum implementation that affected these students for the next two years.

### Purpose

This study will attempt to answer the question of whether or not delivery of the appropriate content was reflected in Georgia's state summative assessment, the Criterion-Referenced Competency Test (CRCT), in sixth grade mathematics in the spring of 2006. Student test scores will be examined to determine how closely the state-mandated curriculum matched the end-of-year test, providing information for future planning in curriculum implementation and assessment.

The state of Georgia is currently in the process of revamping the state-mandated curriculum for all academic areas in an attempt to raise student scores on nationally-normed tests, such as the Scholastic Achievement Test (SAT) and National Assessment of Educational Progress (NAEP). The previous mathematics curriculum promoted a rote-learning approach with basic skills drilled and mastered before moving to higher-order thinking and problem solving. The new standards now require very little teaching of basic skills; instead, teachers are expected to incorporate the basics into higher-level performance and inquiry activities. For example, the previous standards, from Georgia's Quality Core Curriculum, contained a sixth grade standard to address proportion, "Solves for the missing term in a proportion" (Georgia Department of Education, 2003). The new Georgia Performance Standards (GPS) require students to do much more with proportions, such as describe, manipulative, graph, analyze, and solve problems in multiple situations with varying amounts of given information (Georgia Department of

Education, 2005). The tasks under the new standards are much more complex than what students had previously been required to do.

Georgia's goal in changing the curriculum was to produce a more competitive and well-prepared group of students, but their methods for curriculum implementation were questionable. The new math curriculum, with very complex tasks and little focus on basic skills, was implemented beginning with sixth grade, adding the next grade level each year. The students who received the first year of the new curriculum in sixth grade were also the first students to be taught the new curriculum in seventh grade, then eighth, ninth, etc. This group of students, according to test scores across the state, has struggled to understand the new curriculum. Interestingly, the state began the new curriculum in middle school and several years later added it in elementary school. The first several years, the students in the middle school had large gaps in their knowledge of mathematics due to the vast difference in the elementary Quality Core Curriculum and the middle school Georgia Performance Standards. Students throughout elementary school drilled basic skills with little focus on higher order thinking skills incorporated. Then, when they entered middle school, they were expected to be able to think abstractly and apply their learning on a much deeper level than had ever been required of them. The current school year (2008-2009) is the first in which the students entering sixth grade were taught performance standards in the elementary school.

Also difficult for the teachers implementing the new curriculum was the extreme lack of resources. The state cycle for textbook adoption did not provide new math textbooks until two years after the new curriculum was implemented, and the old textbooks did not fit the new content or required teaching pedagogy. Teachers were

forced to create their own materials with the hope that they were appropriate for teaching the standards the way the state intended. The manner in which the state of Georgia introduced their new math curriculum did not provide for long-term goal-setting, learning experiences that were sequential and built on previous knowledge, or teaching materials aligned to the new standards.

The teachers involved in this study were experienced, high-quality teachers with historically average and above test scores for the students they taught. They delivered the curriculum using exemplary teaching practices, but two of them taught the outdated curriculum. The students were not given access to the new state standards, because the teachers continued to teach the same material the same way they had in previous years. Their intentions were noble, in that, they believed the students, if given the old curriculum, would better understand math and would perform well on the state-mandated test at the end of the year, which they believed would not be aligned to the new standards.

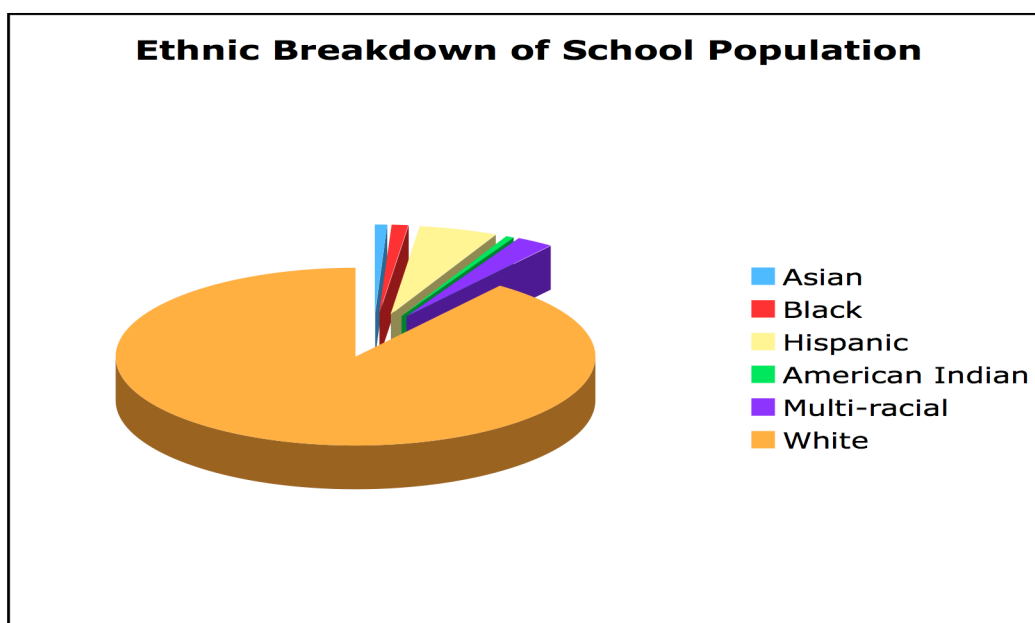
The school participating in the study is located in a small town that relies heavily on tourism to survive. Overall, the community is supportive of the school system, but there are many families with minimal education who do not emphasize the importance of education to their children. The school is a Title I school due to the high rate of poverty and students eligible for free and reduced lunches, currently 58% of the school population.

As seen in Figure 1.3, the school is not very diverse ethnically. The school population is over 89% white, with Hispanic students making up the next largest group with only 5% of the population. Though not ethnically diverse, the students in the school are diverse in resources available to them. About 40% of the population of students

comes from high-end neighborhoods with professional parents who are upper middle class, while the rest are from impoverished communities with parents who are either not working or making wages that fall below the poverty line. There are very few families who fall between poverty and upper middle class. This poses many challenges for all

Figure 1.3

*Ethnic Breakdown of School Population*



who work in the school, as some parents have resources to better support their children than others, resulting in a disparity in the support given to students outside of the normal school day. Though this is challenging for the teachers, the school continues to perform well overall.

The study of these students will compare their fifth grade CRCT scores (pre-test) to their sixth grade scores (post-test) to determine if the instruction they received affected their achievement level. The belief is that the students who were not immersed in the new curriculum did not achieve as well as those who were given the appropriate content.



If this is the case, it should provide school leaders with even more motivation to be involved heavily as instructional coaches in the school, ensuring that the proper curriculum is taught in all classrooms. If no significant difference is found between the two groups' scores, other explanations will be explored, such as a lack of alignment of the test to the new standards and test reliability.

Information from interviews and documents in the school painted a picture of what actually occurred in the math classrooms during the implementation of the curriculum. The teacher who taught the new standards and was asked to re-deliver the training to the other two teachers gave her account of the events that took place that year, including the hostility of the two teachers in training sessions and discussions that occurred throughout the school year about the new standards and upcoming test. Administrators were also interviewed to ensure their accounts of classroom practices in the sixth grade mathematics classrooms matched that of the teachers. Finally, to triangulate the data, the observation notes of all four administrators in the school were examined to glean information about classroom practices that year in the sixth grade math classes.

There are many factors that influence student academic performance, and this study only addressed teacher competency in delivering the required curriculum. Though causation cannot be proven due to the many variables that cannot be controlled, it may be inferred if the scores of the two groups of students are significantly varied between the fifth and sixth grade years when compared to each other. For the purpose of this study, if the scores between the two groups indicate a substantial difference in student achievement, it will be assumed that this can be partially accounted for by the delivery of

the curriculum or lack thereof.

#### Research Question

The study will attempt to answer the following question:

Did the year-end assessment in the state of Georgia in mathematics in the spring of 2006 reflect the new mandated curriculum as evidenced by a disparity between the scores of the students taught the new curriculum and those taught the outdated curriculum?

If the year-end assessment was aligned to the updated curriculum, the scores of the students who received those standards (treatment group) should reflect a higher level of performance than those students who were not given access to the new curriculum (control group). If the test was not properly aligned to the new standards, the scores of the treatment group should not vary significantly from the scores of the control group, or the control group may outperform the treatment group. Examining test scores between these two groups will give valuable insight into the alignment of the test and standards, providing information for school administrators, teachers, and others who make decisions based on standardized test results.

By determining if the performance difference between the treatment and control groups was statistically significant or could have occurred by chance, information will be gleaned about the importance of following the state mandated curriculum in regards to student performance on the end of year assessment. If a significant disparity exists, the data will support closely following the mandated curriculum if the goal is higher student achievement on the test. If there is no disparity or the difference between the groups could have occurred by chance, other factors that affect test performance may need to be

considered, such as alignment of the test and curriculum.

### Hypothesis

One hypothesis will be examined: There will be no significant difference between scores of groups of students that used the specially designed curriculum as compared to those using the old curriculum as indicated by the results of the Georgia Criterion-Referenced Competency Test (CRCT).

If the hypothesis is retained, the difference in scores of the two groups of students will not vary enough to state definitively that the instruction that the students received was strongly tied to the performance on the test. The hypothesis will be rejected only if the data demonstrate a statistically significant difference in the performance of the two groups of students.

### Definition of Key Terms

**Curriculum:** The term curriculum can have several different meanings, including the written curriculum that is followed, the actual curriculum that is taught (which may or may not reflect the written curriculum), the learned curriculum (what students glean from their learning experiences), and the tested curriculum (Cuban, 1992). While teachers are responsible for teaching the written, state-mandated curriculum and students are expected to learn the content from that same curriculum, often the tested curriculum determines what is actually occurring in classrooms. If the state-mandated end of year test actually reflects the written curriculum, the tested curriculum should not differ; this study should provide some insight as to the alignment of the written and tested curriculum. For the purpose of this study, the term curriculum will always refer to the written, state-mandated curriculum unless specified.

**Standards:** Standard, as defined by Merriam-Webster (2008), is “something established by authority, custom, or general consent as a model or example; something set up and established by authority as a rule for the measure of quantity, weight, extent, value, or quality” (Standard, 2008). In education, standards are typically set by state departments of education, though increasingly, schools and states are beginning to recognize national standards created by professional content-specific organizations. Standards should represent goals for students in regards to a particular content area. Basically, they are what students should know and/or be able to do upon mastery of a specific content. For this study, the term standards refers to the specific items listed in the written, state-mandated curriculum that are to be taught each year and should be the basis of the standardized, end of year test given each student.

**Testing:** Issues in testing will be discussed throughout this study. Several key ideas in regards to testing are important to understand, such as high-stakes testing, standardization, and the definition of criterion-referenced. All of these terms will be utilized when discussing the events that occurred in this study.

**High-stakes testing:** Testing that is considered high-stakes is used to make important decisions for schools, teachers, and students. For example, in Georgia, the end of year test determines Adequate Yearly Progress for schools, decisions about the quality of personnel in both administration and teaching, adequacy of the school in comparison to the state and other schools, and promotion or retention for students in certain grade levels. In this age of accountability in education, results on high-stakes tests have become so crucial that the tests influence the everyday operation of schools and classrooms.

**Criterion-referenced testing:** The end-of-year tests typically given in states are criterion-referenced, meaning they test student knowledge on specific criteria that should be directly related to the standards in the written, state-mandated curriculum.

**Standardized testing:** Testing in which procedures for conducting testing are standard, with scripts provided for teachers, limits on time allotted for each test section, and strict guidelines on appropriate behavior for both students and examiners.

### The Study

This study was being conducted to give insight into curriculum implementation and standardized testing with the hopes that the information gleaned will better equip states to develop long-term goals and plans when making changes and schools will understand the effect of teaching the mandated curriculum if test performance is considered a priority. By examining the effect of teaching practices on student test scores, school leaders should be armed with more information to be able to better function as instructional leaders. Politicians interested in education as a platform may also be interested in the results of this study as they revise legislation, such as No Child Left Behind, that affects curriculum and standardized testing.

## CHAPTER TWO: LITERATURE REVIEW

This comprehensive review of relevant literature was conducted using various on-line and print resources, both historical and current. Several key topics emerged through the literature relating to curriculum, instruction, assessment, professional development, and change implementation. This review is not exhaustive, due to the large body of research in the field of mathematics and curriculum change; however, it highlights the most relevant literature related to the study.

### Historical Background

Student achievement in mathematics has been a documented issue in the United States since the early 1900's (Klein, 2003). Many scholars, business leaders, and politicians have been involved in the debate over how to best educate students in the field of mathematics, and to date, there is still no general consensus on the issue. There is growing concern that American education is not a competitive force internationally and that our ability to compete in the technological marketplace will decline if we do not improve the way in which students learn mathematics (Gordon, 2007). In 2005, a report entitled *Rising Above the Gathering Storm* was released, and it stated that only about one-third of eighth grade students are considered proficient in math (National Academy of Sciences, National Academy of Engineering, and Institute of Medicine, 2005). Because of this report, the federal government allotted \$33.6 billion, named the COMPETE Act, to fund grant programs to increase rigor in math, science, technology, and engineering (Committee on Science and Technology, 2007). While this increase in funds will be helpful to schools, without specific guidance and a clear vision of what is needed, this

will probably not solve the problem..

Often in studies and discussions regarding the state of mathematics in this country, American students are compared to other students internationally. It is important to use caution and consider differences in culture, curriculum, and the school calendar (students in the U.S. attend school 180 days each year, while Japanese students go to school 240 days a year) (Jones, 1988). Keeping this in mind, students in Singapore, a country which appears to have an effective mathematics education program, are offered a separate curriculum if they are considered lower-level learners in math. In this alternate curriculum, students are exposed to the same standards as higher-level learners but take a slower pace and are allowed more time to practice skills (Ezarik, Lessons, 2005). Ezarik (Lessons, 2005) suggests that American students who are lower level learners in math be given extra time and assistance to learn important concepts. Jamshed (2008), who grew up and attended school in India, gives an insider's view of Asian education, saying that students choose a focus in school before high school and receive a very deep yet narrow curriculum based on that choice. Students who choose fields in mathematics are highly educated in mathematics but learn little about humanities or the arts. Schooling there is based on rote memorization and scripted learning. He believes that the American way of educating students produces more well-rounded, better-educated adults who can think freely and have deeper understanding of content due to the many connections made with other disciplines throughout schooling.

A study conducted by Welch, Anderson, and Harris in 1982 addressed whether schools could actually affect a student's understanding of math in light of the many factors that influence today's youth. Prior to this study, there was no strong correlation

between math instruction and math achievement and only a small relationship between home/community factors and math test scores. The authors believed the previous studies were flawed in their design and that instruction and home/community factors had a major influence on math achievement. They used national data from National Assessment of Educational Progress (NAEP) testing, comparing data of the whole population of students who took the test and several small samples from that same large population to ensure the results matched. Using a multiple regression analysis, they compared test scores in regards to community variables and the amount of previous math courses students had completed. They found that 24% of the variance in test scores could reasonably be attributed to home/community factors, and previous math courses contributed to another 34% of the variance. This study gives hope for math instruction and for school reform efforts, showing that schools can increase student achievement in math regardless of home/school factors. It also shows the strong relationship between home/community factors and student performance, requiring schools to examine ways to involve the community more in education (Welch, Anderson, & Harris, 1982).

The growing push for accountability in schools is altering the way educators think and are motivated. The goals of No Child Left Behind (NCLB), according to Hursh (2005), are to graduate students who can compete in a global economy, close the achievement gap to provide equitable opportunities for all students, and ensure that measures of achievement are subjective. The problem is that the opposite has happened. Hursh believes that students are not prepared for the global workforce because the curriculum has changed to focus only on test preparation, the achievement gap has widened as schools focus resources to benefit students who passed or almost passed the



test leaving those in the bottom tier to fail, and tests are increasingly scrutinized and found to be invalid measures that are full of bias and incorrect information (Hursh, D., 2005).

#### Theoretical Background/Theoretical Framework

This study was built on theories regarding the relationship between standardized testing and what is taught in classrooms. Scott (2001) defines standardized testing as a measure of specific items believed to be representative of a large body of knowledge that can be used to make inferences about a student's mastery of content. Basically, the test should contain a sample of concepts taught within a curriculum that can be used to judge whether a student has mastered those concepts or not. The assumption is that the test was well-planned, fully aligned with the curriculum, and truly representative of the skills that are required to demonstrate mastery of that curriculum. Popham (2001), while not fond of standardized testing, does find merit in assessment of any kind that is used for instructional measurement and improvement. He believes the purpose of assessment is to measure what students know and to then alter instructional practices to re-teach those concepts that were not learned correctly the first time and plan for future learning experiences based on prior knowledge demonstrated. In Popham's definition of assessment, curriculum and assessment are intertwined and fully dependent on each other. Theoretically, a standardized test should measure a broad sample of the curriculum and yield results that are valid for the purpose of diagnosing student learning to improve instructional practices.

## Related Research

### *Curriculum*

The question of curriculum is a difficult concept in dealing with mathematics because there are so many viewpoints and opinions regarding how students learn math. There is a debate as to whether courses should be specific courses focusing on one aspect (geometry, statistics, algebra, etc.) or integrated courses that teach multiple aspects of math in one course. In 2005, New York was moving away from teaching integrated courses due to demands placed on them for accountability under NCLB, while the Georgia Department of Education decided the same year to move from specific courses to an integrated format to increase academic rigor (Ezarik, Math, 2005). The school in this study is in Georgia, and they are in the process of changing the curriculum to be more integrated; this is difficult for students who do not have the previous skills needed to be able to function in this new curriculum.

In May of 2008, the President's National Mathematics Advisory Panel determined that the United States is falling behind other countries internationally in mathematics education and that the curriculum needs to be altered. The panel believes that students in this country are given too many concepts to learn each year without mastering the ideas previously taught. Their advice is that state curriculum be altered to narrow the scope of what teachers are asked to deliver but cover each standard in greater depth for better understanding by the students (Brown, 2008).

According to Steen (2007), mathematics courses are weakening as more students are forced to take them for graduation. The curriculum for Algebra II continues to be watered down in many states to allow a large percentage of students to be able to pass the

course, which is required for graduation. This leaves the students who are taking higher-level mathematics courses with a weakened foundation and gaps in their knowledge that must be addressed for them to be successful in the more difficult courses. Math courses can be very frustrating to students that see no real relevance to their lives. Many who will go to college are having problems understanding why they need to learn concepts because there is no immediate reward. Teachers need to find ways to spark these students interests and make math relate to them on a more personal, real-life level to help them find motivation to endure and persevere (Steen, 2007).

According to Hargreaves, Earl, Moore, and Manning (2001), many countries have moved to a more specific, standardized curriculum that is narrow in its scope and does not leave room for teacher interpretation or content integration. Because of the lack of input by teachers in creating the standards and the specificity of the standards leaving little room for creativity, teachers appear to resist implementing the new standards. There also is often a general feeling amongst teachers that the curriculum will change again in a few years, so it is futile to put a lot of time and energy into fully implementing the new change (Hargreaves, et. al., 2001).

A study on the relationship between the taught curriculum and the state assessment was conducted in Maryland. The researchers there found that the instruction in the classroom typically matched the summative state assessment, but the assessments the teachers used did not (Parke & Lane, 2008). This is an interesting finding for teachers. If the formative assessments used to guide instruction do not match the state summative assessment, how can instruction align so well?

Alignment of the written curriculum and the taught curriculum is crucial if

students are going to demonstrate gains on state assessments. Within a school, as teachers collaborate to align curriculum across and between grade levels, they begin to adopt a shared goal for student achievement and outcomes that becomes more in line with the required curriculum. If one teacher strays in a school that pushes for school-wide alignment, the other teachers can guide him or her back to the correct standards or teaching methods (Sebring, Allensworth, Bryk, Easton, & Luppescu, 2006).

### *Performance-Based Standards*

The current trend in many states is a move from traditional teaching to a performance-based approach. Rather than teach a lesson and assess student mastery with a multiple-choice test, performance-based activities require that students demonstrate understanding through experiments, projects, or other activities (Khattri, Kane, & Reeve, 1995). The Georgia Department of Education began a revision of curriculum for academic courses in 2005, known as the Georgia Performance Standards (GPS), that requires more experiential learning in the classroom. The former standards were very general, leaving much interpretation to the teacher to determine the extent to which students learned certain concepts, while the new standards are specific, giving not only the content required but also suggestions for teaching tasks and assessment (Georgia Department of Education, n.d.). The hope was that, by taking some of the guesswork out of a general curriculum, students would be more prepared on specific concepts to be able to compete on state and national assessments.

Noddings (2008) addresses the need for schools to teach critical thinking to their students. This involves planning, seeking meaning, reflecting, questioning, and making judgments about content. Too often, students memorize material just long enough to pass

a test and then quickly forget it because it has no connection to other content or real life. Without a real life connection, education becomes fragmented and without purpose. McKinney and Frazier (2008) studied mathematics classroom practices in high-poverty high schools and found that very few teachers were using hands-on activities to reach students. For the most part, lecture was used, which hindered the application of higher order thinking skills (McKinney & Frazier, 2008).

Rather than simply teaching content, Mansilla and Gardner (2008) believe that teachers should help students be able to think the way an expert in that content area would think. They state, “The goal of this approach is to instill in the young the disposition to interpret the world in the distinctive ways that characterize the thinking of experienced disciplinarians- historians, scientists, mathematicians, and artists” (pg. 14-15). Schools teach students disciplines that are separate from each other and can be reduced to a list of facts and dates learned in isolation and with little meaning to a student. Because of this, they have a difficult time applying knowledge when asked to do so. Disciplining the mind to think like an expert involves identifying the most important content in that discipline and studying it deeply, looking at it many different ways and using inquiry. By doing this, it is believed that students will develop a greater understanding of how to think critically and apply knowledge to other disciplines (Mansilla & Gardner, 2008). This active learning creates experiences for students that are memorable and meaningful.

### *Textbooks*

It is typically not acceptable in education to allow a textbook to dictate the taught curriculum, however, often it does. Particularly in math courses, teachers tend to rely

heavily on the textbook to determine what to teach and when to teach it. Because this is frequently the case, schools need materials that are aligned to the mandated curriculum to ensure alignment. It is essential that a committee of competent content experts review textbooks and supporting materials thoroughly before making a decision. They should look for content reflective of state standards, presentation of material that aligns with best practices in instruction, and professional development components that assist teachers in implementation (Reys, Reys, & Chavez, 2004).

Putnam (1992) conducted a case study of a fifth grade math teacher to glean information about her participation in curricular change. He found that, in her particular district, there was little communication about what was expected from teachers. Textbooks were selected at the district level with the expectation that teachers would teach the concepts in that book (Putnam, 1992). In a district such as this, selection of a textbook aligned to the required curriculum is essential.

#### *Previous Courses Completed in Mathematics*

Previous courses taken in mathematics before and during high school are correlated with a student's success in higher-level mathematics, such as calculus. Students who are given the opportunity to take more difficult math courses have a better chance for success in upper-level courses later in high school (Welch, Anderson, & Harris, 1982). Ma and Willms (1999) found that many minority and low-socioeconomic students are often tracked into lower-level math classes from an early age, depriving them of the opportunity to learn the necessary skills for success in higher-level courses. This study is intended to be an equalizer that will close achievement gaps in mathematics early in a student's education to prepare him or her for higher-level courses in high school.

The greater amount of time spent in math instruction each day will also contribute to better preparing these students. Jones states (1988):

The opportunity to learn is a function not only of course offerings and student enrollment in courses, but also of hours of instruction, time on task during instructional periods and freedom from distractions, the amount and quality of homework, the appropriateness of course content, and teacher qualifications and teaching effectiveness (pg. 327-328).

Noddings (2008) feels strongly that students should not all be treated the same and be provided the same math coursework. For instance, students who will be carpenters need math classes that focus on skills needed for carpentry rather than Algebra. Schooling and coursework should be focused on students' long-term career goals, and they (the students) should have a choice in the types of courses they wish to take. This is fundamentally different than the direction states appear to be moving in curricular change.

Though all of these factors seem to affect student achievement in mathematics, it would not be possible to study them all in conjunction with the treatment in this study.

This study focused on student enrollment in the program and additional hours of instruction provided for those students included in the sample.

Minority students across the nation are severely underrepresented in higher-level mathematics courses, according to Walker (2007), sparking debate as to why that is and how it can be corrected. She believes that schools are still tracking minority students into lower level classes, regardless of their ability level or desire to succeed in school, resulting in a lack of pre-requisite courses for advanced-level courses. She also states

that teachers often do not encourage these students as often to pursue more difficult coursework and do not provide the level of support necessary to help prepare them to take the correct coursework academically. Minority students in higher level classes often feel out of place, a problem she believes can be corrected by ensuring that minority students take those courses together to reduce the isolation they feel in a class full of white students. Whatever the cause, the gap between white students and minority students is widening and must be dealt with immediately (Walker, 2007).

Studies have also shown a discrepancy in the percentage of females participating in higher-level math and science courses. Penner and Peret (2008) believe this can be attributed to parental support for mathematics for females beginning as early as kindergarten. Males tend to perform better than females in all comparison groups (when controlled for socioeconomic status and ethnicity). When examined with the above studies that show a marked advantage for white students, it appears that white males have a distinct edge over all other groups of students in mathematics courses. While this has been shown to be the case, there are no proven solutions for closing the achievement gap, only suggestions as to what may have an effect on raising achievement for all students.

### *Instruction*

There are many theories on how students best learn math and the appropriate methods to employ when teaching new concepts. A study recently compared math assessment results when students were taught with a multiple intelligences approach versus direct instruction, and students in the multiple intelligences classrooms considerably outperformed their counterparts (Douglas, et. al., 2008). Multiple intelligences address learning styles of different types of students. Intelligences, as



described by Howard Gardner, are: Linguistic, musical, logical-mathematical, spatial, bodily-kinesthetic, and personal. According to Gardner, if a student is more spatial oriented, lessons should be presented in a manner that utilizes this strength if deeper understanding is desired (Gardner, 1983). Direct instruction is a teaching method that is scripted and does not allow for teacher interpretation. The National Institute defines direct instruction (n.d.) as:

...a model for teaching that emphasizes well-developed and carefully planned lessons designed around small learning increments and clearly defined and prescribed teaching tasks. It is based on the theory that clear instruction eliminating misinterpretations can greatly improve and accelerate learning.

Teacher creativity is basically eliminated and replaced with a standardized lesson that is not tailored to each student's interests or needs.

With the national push for inclusion of all students in the regular classroom and the pressures of NCLB/AYP, teachers are forced to find new ways to reach a diverse array of learners. Traditional instruction typically is directed at the average learners, leaving behind the slower learners and higher achieving students. REACH is a recommendation for how to differentiated teaching to reach all learners in a classroom. It stands for, "(a) reflect on will and skill, (b) evaluate the curriculum, (c) analyze the learners, (d) craft research-based lessons, and (e) hone in on the data" (p. 34). This requires knowing the students and recognizing their strengths and weaknesses and customizing the curriculum and lessons to ensure success for all students in the classroom. In teaching this way, teachers are reaching a diverse group of students who previously did not achieve at the level of their peers due to a one-size-fits-all instructional

program (Rock, Gregg, & Gable, 2008). Anderson (2007), another proponent of differentiating instruction to meet the needs of all learners, emphasizes the role learners play in the classroom as they set personal goals and make choices related to their learning.

George (2005) addresses the need for differentiated instruction in today's classroom as a means of preparing students for the diverse world in which they will function as adults. The typical workplace is made up of a heterogeneous mix of people in regards to ability, intelligence, socio-economic status, and ethnicity. To truly prepare students to be successful, it is crucial that schools provide opportunities for students of all different backgrounds and abilities to work together and learn from each other. He also stresses that resources are more likely to be equitably distributed if schools are heterogeneously grouped, with quality teachers placed not just with high performing students. Differentiation in the classroom is essential to ensuring that each student is successful and realizes his or her full academic potential. To do so in a diverse environment will better prepare students to function in today's diverse world (George, 2005). Tomlinson (2005) believes that differentiation is very difficult for teachers because they have not been given the skills to understand the concept. The idea also appears to be in conflict with the traditional grading systems used in schools. To truly meet the needs of each student in a classroom, the teacher must be very flexible in grouping students and create a culture within the class that resembles a supportive family (Tomlinson, 2005). By taking the fear out of learning, teachers can more easily reach those students who tend to lag.

Students often blurt out answers to questions in class or answer test questions

quickly without fully thinking through what is being asked. Costa (2008) gives suggestions for how to encourage, or teach, students to think before answering, resulting in deeper understanding of content. The first suggestion is to help students learn how to think through questioning and model thinking processes. Students should then use that thinking process to inquire, assess, and question the content being taught. Group activities and discussions that expose students to each other's ideas and opinions also help students think more critically about what they are asked to learn. It is important that students be asked to think beyond just their classroom to gain a more global perspective on topics. By helping students think more critically in the classroom, it is the author's hope that they will then carry this life skill into the global workforce (Costa, 2008).

According to Hyde (2007), reading strategies can be used in the mathematics classroom to help students more easily understand math concepts. Strategies such as making connections between something you read and something else with which you are familiar are suggested to help students find real life relevance in their math coursework. Hyde also suggests that word problems should not be given to students with the understanding that they simply take the numbers from them, plug them into a formula, and compute an answer. Students should actually read and comprehend what the problem is asking, visualize the task, and then begin working to find an answer. This should allow students to be able to apply their learning to similar problems when they encounter them later. By using reading strategies in the math classroom, students should gain a more connected, real knowledge base for future mathematics courses (Hyde, 2007).

A study conducted by Woodward and Brown (2006) focused on students who

were not served in special education for math but who struggle in math. These students were split into two groups, one who received the same instruction from the same materials as all other students in that grade level, and one who received instruction from materials specifically designed for special education students. Those receiving the special education materials greatly outperformed the group taught using the normal, general education materials (Woodward & Brown, 2006). The results from this study give insight into one manner in which teachers may be able to reach the students who tend to historically perform on a lower level with no hope of improving. Perhaps modified materials and flexible class groupings can allow these students to experience success in the classroom while also helping schools and systems achieve AYP.

Crucial to understanding concepts is the engagement of the students in their learning. Weiss and Pasley (2004) studied schools across the nation and found that many teachers delivered the appropriate, challenging content but not in a manner that truly involved the students. To conduct high-quality lessons, they insist that students must be actively engaged with the content, manipulating it or applying it in some way. They also found that the classes in which students were the least involved in learning, due to teacher lack of confidence in their abilities, were classes containing a high percentage of minority and low ability students (Weiss & Pasley, 2004). This is disturbing since those students are the ones who tend to be the deciding factors for AYP for many schools.

In response to the mounting pressure placed on schools to perform, schools have altered classroom instruction to reflect the make-up of the standardized test given at the end of the year. The Center on Educational Policy conducted surveys of multiple rural school districts, and of those who considered themselves successful, they reported that

much of their success could be attributed to the alignment of the curriculum with the end-of-year, high-stakes test (Center on Educational Policy, 2008).

### *Mathematics Teachers*

The role of the teacher in providing instruction is critical for student learning. A study of teachers in the UK found that individual teaching strategies that have been proven to be effective increased student achievement a small amount when used in isolation, but when used collectively, as a master teacher would, very significant gains are made (Muijs & Reynolds, 2000). Kimball, White, and Milanowski (2004), however, came to a different conclusion about teacher effectiveness and student achievement. In their study that correlated teacher evaluation measures with criterion-referenced test scores, there was not a very strong connection between the two. A study of reform implementation found that teachers alter content and materials based on their belief system about the reform and to accommodate the students they teach. Changes differed depending on the individual teacher, and very few were able to implement the program exactly as it was intended (Kyriakides, Charalambous, Philippou, & Campbell, 2006). These findings emphasize the role of human behavior in teaching. Teachers are freethinkers who have ideas about how students should be taught, and they will hold true to those beliefs no matter what. Amrein-Beardsley (2007) believes in the power of teachers by stating that the only way to correct inequities in education is to recruit high quality teachers to schools that are considered to have difficult working environments. She opposes standardized testing as a means to improve education, instead placing the emphasis on those actually delivering information to students (Amrein-Beardsley, 2007).

Another issue strongly related to instruction is the prior training of the teacher.

With the shortage of teachers in this nation, the definition of “highly qualified” is rapidly evolving to include many individuals who were not trained in the traditional manner to become teachers. Though it would seem as though teachers who use alternative methods to certification would not be as effective as those who have a college degree in education, Gimbert, Bol, and Wallace (2007) contend this is not the case. Their study found that students taught by alternatively certified teachers performed equally as well as those taught by teachers with traditional certification. This leads all stakeholders in education to question the value of the teacher in the classroom.

Continuing education, or professional development, is typically well funded, particularly in schools labeled “needs improvement”, and is viewed by most educational leaders as crucial to the success of the school. Mohammed (2006) found that the culture created by teachers in a school is so strong that most new concepts taught during in-service training sessions are never implemented due to lack of support. Teachers receive new ideas in these sessions but abandon them upon returning to the classroom due to pressure applied by colleagues to conform to the dominant culture in the school (Mohammed, 2006). There is strength in numbers. In the school used in this study, two teachers banded together to resist the new curriculum, and the teacher providing the training was alienated.

### *Assessment*

In today’s schools, assessment is focused on teacher accountability and evaluation but is not used often enough to improve instructional practices. For lower achieving students, the authors suggest ways to be able to use assessment to drive instruction, including student interest inventories, error analysis, and identifying gaps in knowledge.

The idea is to make learning personal by connecting to student interests while also analyzing student work to identify areas in need of improvement and to understand the thought process used to incorrectly answer a problem. Also critical in teaching lower performing students is making all concepts as concrete as possible. It is difficult for some students to understand abstract ideas, so to help these students, the teacher needs to connect each new idea to something concrete that students can use to make a connection to real life. This should result in students who are more successful in math and have a greater understanding of all concepts studied (Allsopp, et. al., 2008).

Alignment is an issue when testing students on required content. South Dakota partnered with the Buros Center for Testing at the University of Nebraska to examine the alignment of the South Dakota math curriculum and the end of year criterion-referenced test of the math standards. The Buros Center found that, for the most part, the test and curriculum were aligned; however, because they were not fully aligned, the recommendation was for the state to do alignment studies on every test item in every grade level (Foley & Buckendahl, 2007). This should probably be done in every state that has a mandated curriculum and end of year test; however, the cost to do so would be tremendous. The benefit would be that the test would actually measure student mastery of the required standards, and results could be used to make decisions regarding curriculum and instruction that would be meaningful and valid.

An alignment study was also conducted in Maryland to determine the extent to which classroom math activities aligned with the state assessment. The study concluded that, for the most part, the instruction in the classroom was aligned with the state standards at a very high rate; however, the assessment appeared to be aligned with the

standards at a much lower rate (Parke & Lane, 2008). It would seem as though instruction aligned with state standards would yield high results on an assessment that is based on those standards, however, too often, these assessments are not really measuring the standards they represent.

### *Standardized Testing*

While standardized testing is a main focus for accountability throughout the nation, there is much debate as to the value and relevance for students. Nichols and Berliner (2008) state that the gains students are demonstrating on state standardized tests (required for No Child Left Behind) are not reflected on nationally normed tests (National Assessment of Educational Progress, or NAEP). They also believe that the focus on standardized testing in schools has led to a more narrow, test-driven curriculum, cheating and/or manipulation of data by teachers and administrators, and schooling that has lost its excitement for students. Teachers are teaching test items in a repetitious manner and abandoning projects that give learning real meaning for students. Teachers and school administrators are operating in a culture of fear that they will be labeled a school in need of improvement, so they build their entire school improvement process around standardized test scores (Nichols & Berliner, 2008).

A study conducted over a 10-year period by Nichols and Berliner (2005) found many cases of cheating on standardized tests by administrators and teachers. These incidents included: Coaching students, sharing test items prior to administration, giving students the correct answers, allowing extra time for test administration, and changing students' answer from incorrect to correct. In nearly all of the cases, there was a high-stakes decision that hinged on student performance on the test, such as teacher pay



incentives or federal funding. They attribute this cheating to Campbell's Law from the field of social science (Nichols & Berliner, 2005) which states, "The more any quantitative social indicator is used for social decision-making, the more subject it will be to corruption pressures and the more apt it will be to distort and corrupt the social processes it is intended to monitor" (Campbell, 1976, pg. 49). If this is true, standardized testing practices, when made high-stakes, are going to corrupt schools and education as a whole.

The goal of standardized testing in school should be to assess students' learning to plan for future learning experiences. If the test is not used to benefit students in the classroom, it may be a waste of time. Thompson (2008), in a study of black and Latino, inner-city students, found that a large percentage of students had not tried their best on a standardized test because they felt as though the test had no value or relevance to their lives and/or education. If students do not value the assessment and give their best effort, the results become meaningless for any type of decision.

In a study of pre-service teachers' attitudes toward their upcoming profession, Ng (2006) found that an overwhelming number of future teachers chose teaching as a career because they felt as though they could make a difference in children's lives. While they held this belief, many of them feared that policies currently in place that mandated high-stakes testing as indicators of school quality would prevent them from doing meaningful activities that would truly benefit students. They wanted to use hands-on, creative activities that connected content to real life, but they feared that if they abandoned test preparation and drill-and-kill strategies that students may not perform well on the end of year test. The standardized test, from the beginning of these teachers' careers, is going to

determine their instructional practices (Ng, 2006).

Schiller and Muller (2000) examined the effect of high-stakes testing on high school graduation rates and found that when schools are held accountable for student performance on tests, graduation rates decrease as teachers' low expectation of student performance is inadvertently displayed in the classroom. However, when students are required to pass such tests and are the ones held accountable, graduation rates increase, weakening the relationship between student performance and low teacher expectation (Schiller & Muller, 2000). Basically, standardized tests that set required content mastery for graduation appear to help more students achieve on an acceptable level and overcome many of the stereotypes and obstacles faced in finishing high school. In a study of eighth grade test takers, Ryan, Ryan, Arbuthnot, and Samuels (2007) examined motivation and beliefs of high-achieving math students in regard to standardized tests. They found that the students' attitudes varied greatly about the value of the test, the purpose, and in how they felt about taking the test (from nervous to indifferent to excited). Their preparation for the test varied as well, with some students extremely disorganized and possessing few coping strategies for working through test items and others well prepared to calmly work through test items. The authors suggest more research in this area. They encourage schools to ensure that students are given test-taking skills and strategies and that the students understand the purpose and value of any assessment before it is given (Ryan, et. al., 2007).

In Lebanon, where there is a national curriculum and corresponding high-stakes standardized testing, results from those tests are used to evaluate effectiveness of teachers and schools, as well as student achievement. Because of the pressure placed on teachers

for their students to perform well on the tests, Osta (2007) observed that teachers are allowing the test to determine the content that is presented in their classrooms. The national curriculum in Lebanon was rewritten several years ago to include more higher order thinking skills and hands-on, performance-based activities. Though tests were created to mirror the curricular changes, it does not appear as though the test is actually aligned to the new curriculum. Osta believes this is because, through many years of testing, the entire country has created a belief about the way students are tested, and this belief has become such a part of the educational culture that it cannot be changed. By constantly assessing students in the same manner, the curriculum itself has narrowed to only include those concepts that will be included on the year-end test (Osta, 2007).

Standardized tests are valid and useful when they measure what students should know and be able to do and when the feedback offered is constructive for teachers to alter instructional practices to better implement curriculum. The problem today is that too often these tests are biased against groups of students and are used as a single measure to make high-stakes decisions, such as graduation, promotion to the next grade level, or teacher pay and incentives. Without knowing absolutely that every test question aligns with the mandated curriculum and is free of bias, it is not fair to hold students accountable with the test as the only measure of success or failure (American Psychological Association, 2001).

#### *Professional Development for Teachers*

Professional development is crucial when implementing new efforts in any organization. Its purpose is to educate all staff members to help them maximize their potential in their occupations. Rebores (2001) states:

The primary purpose of a staff development program is to increase the knowledge and skills of employees and thereby increase the potential of the school district to attain its goals and objectives...It is obviously unproductive to assign or endorse an activity without considering how this activity helps to meet goals and objectives (pg.167).

Professional development is not optional and should be well planned to meet the changing needs of a school and school system. Conducted correctly, these programs can be a wonderful source of information and innovation for teachers and other staff members.

Errors are common in planning professional development. Some ineffective characteristics include: Poor planning, lack of support and resources, little or no feedback and coaching for participants, and programs not based on theory or useful concepts (Killion & Kaylor, 1991). Too often, principals and other administrators do not study the literature on effective professional development and make these mistakes. It is common to present an idea one time in a lecture format and expect teachers to apply the concept in their classrooms (Darling-Hammond, 1997). This only frustrates teachers and makes them feel inadequate to do their jobs in the manner desired by the administrators.

Glickman, Gordon, and Ross-Gordon (2001) combined eight studies and created a list of sound practices in professional development. Common ideas were: Involving participants in all aspects of programs (planning through evaluation); basing programs on goals; planning and development, short and long-term; incorporating research and best practice on school improvement and instructional improvement; providing administrative support (time and other resources); using principles of adult learning; studying research

on change; coaching and supporting while knowledge is transferred to the classroom; providing ongoing assessment and feedback; and making continuous professional development a part of the school culture (Glickman, et. al., 2001). Although this may seem idealistic, it is possible if administrators truly want to develop quality employees that are growth-oriented. Blase (1998) believes that effective school principals view all individuals in the school as lifelong learners, coaches, colleagues, and collaborators. Keeping this in mind while planning learning experiences will help ensure that time is well spent and content is meaningful.

Benton and Benton (2008) give suggestions to create learning experiences for teachers that are meaningful and applicable in classrooms. They encourage leaders to plan extensively, including needs assessments and goal setting, before conducting any training, utilize multiple instructional methods in the training session, and evaluate the quality and usefulness of the training (Benton & Benton, 2008). Rebores (2001) emphasizes conducting needs assessments involving: Teacher needs, community ideas, curricular changes, and requirements for teaching certificates. Kratochwill, et. al. (2007) stress the importance of preparing the staff before the training, ensuring administrative support, and planning for on-going follow up to the training if lasting change is to occur. Guskey (2000) stresses the importance of evaluating professional development to ensure it meets the desired goal and is understood by its participants. He believes that this step is often missed because educational leaders do not feel qualified to be able to judge the quality of a program. Guskey believes that no special skills are required, only the ability to ask questions to gather information about the topic covered (Guskey, 2000).

Professional development programs must be based on adult learning theories.

Malcolm Knowles, in the 1980's, studied adult learners and the ways in which they should be taught. His study yielded five principles of adult learning: Adults are intrinsically motivated to learn; adult orientation to learning is life-centered, not subject centered; experience is the richest resource for adult learning; adults need to be self-directing; and adults want to immediately apply their knowledge (Knowles, 1984). Failure to consider these principles can be fatal to a professional development program. Teachers must view a program as meaningful and useful to be able to benefit from it. According to Fullan (1990), programs that lack proper planning and execution do not improve instructional practices or student achievement and often result in poor teacher morale.

Professional development programs are more effective if they involve participants in all aspects, from planning and needs assessments to evaluation and future planning. Teachers who have input into the types of programs in which they participate and the manner in which they learn will be more likely to take responsibility for that learning. They will be more motivated and will see the value of applying their new knowledge (Blase & Blase, 1998). Top-down, bureaucratic programs have little value in education. Seyfarth (1996) states that most professional development programs are planned at the central office level with no input from those who will participate in them. They are not typically quality programs and result in teachers not wanting to take part in professional development. Many times in schools, the teachers can pinpoint problems and give possible solutions due to the fact that they are actively involved in educating students. Administrators need to use this valuable resource and allow teachers the freedom to plan their own development activities.

Coaching is a very important aspect of professional development. By having a peer observe in a teacher's classroom and give feedback as to the development of the skill learned, the skill is refined. Coached teachers more fully understand the reasons for the new methods or ideas and are more likely to retain the knowledge and incorporate it into their teaching. Coincidentally, the teacher providing the coaching also learns and grows through the experience. Coaching will work well for teachers if the person who is coached trusts their coach and is willing to accept constructive criticism from him (Joyce & Showers, 1983).

To ensure long-lasting effects from professional development activities, it is critical that the culture of the school support innovation and risk-taking. Mohammed (2006) studied a group of teachers learning innovative methods for teaching math in Pakistan and followed those teachers back to their classrooms to determine the extent to which they were able to apply the new ideas. He found that the teachers were excited and recognized the value of the new teaching methods when they completed the training, however, they immediately abandoned the new ideas and returned to more traditional teaching when returning to the classroom. Reasons for this were: A lack of support from and collaboration with colleagues, fear of administration disapproval for evaluations, and few resources to assist with implementation (Mohammed, 2006).

Evaluation is a critical component of any professional development program, according to Weller (2000). Every program should be evaluated throughout the program and at the end to determine its effectiveness and quality. This can be accomplished through the use of surveys, classroom observations, tests on content, interviews, and rating scales. During the program, formative evaluation should be conducted to

determine how the program is progressing and if anything needs to be changed to make it more successful. At the conclusion of the program, summative evaluation should be conducted to gauge the overall success and value of the program. This information should guide future professional development ideas and programs.

Resources are essential to professional development and should be provided by the school or school system. Time is a valuable resource. Teachers and other employees should be granted time to participate in professional development activities. This time can be in the form of professional leave (having a substitute), salaried time, or time paid by a stipend, but it should never be on an employee's own personal time (Weller, 2000). Blase and Blase (1998) conducted a study on professional development and found that the availability of resources did not negatively affect teachers' attitudes toward programs, but teachers were more likely to be reflective and improve classroom practices if proper resources were provided. Funding must be provided to ensure a quality program (Blase & Blase, 1998). School space, materials, and equipment are also valuable resources for professional development and should be provided by the school. If possible, incentives should be available for participants. Some examples of possible incentives are: Release time, refreshments, stipends, credit for certificate renewal, college or university credit, reimbursement for expenses incurred for activities, and advancement on the salary schedule (Weller, 2000).

When moving from a curriculum that is general and can be taught using only a textbook to one that is performance-based, requiring many other resources, teachers need professional development activities that give them the necessary tools to be able to implement the new curriculum (Little, 1993). Too often in education, reform is mandated



with little regard to teacher preparedness and resources. If a program is to be successful, it is essential that those responsible for implementation understand what they are being asked to do. Reboire (2001) sums it up by stating that it is not possible to work in any profession for an entire career without learning any new skills. He believes schools need to make professional development a priority and be willing to fund programs to ensure faculty and staff remain current on best practices and skills needed to teach in current day schools. Administrators, state departments of education, and any others who are assisting in school reform and change must take this seriously if those reform efforts are going to be successful.

### *Instructional Leadership*

In a case study including four school principals in challenging schools, Ylimaki (2007) found that all of the principals were able to raise student achievement, as measured by standardized test scores, in their schools while all using differing methods to do so. The factor they all had in common was a vision of and desire for strong instructional leadership within the school. Two of the more experienced principals were able to draw on their previous successful experiences, while the other two new principals examined current research and what worked in similar schools. Despite their differences, they all maintained that their focus on instructional leadership inspired teachers to improve their practices, resulting in higher student test scores (Ylimaki, 2007).

Printy and Marks (2006) extend the term instructional leader to include teachers and not just school and district administrators. They believe that with a strong partnership between an instructionally strong principal and empowered teacher leaders, schools will show strong growth in student achievement (Printy & Marks, 2006).

Instructional leadership can be maximized in the school by using these teacher leaders as coaches for their peers.

A study of special education and instructional leadership found that many school principals do not understand special education or the methods available to providing instruction to these students; therefore, they are not able to provide instructional leadership for special education teachers. In these cases, peers learned from each other with little guidance from school and/or district administration (Bays & Crockett, 2007). Weller (1999) suggests that an effective school leader spend time in all classrooms in the school, not just observing but providing assistance and guidance for the teacher while modeling effective instructional practices. To be able to do this, the principal must have a strong foundation in best practices in teaching. Without a well-rounded knowledge base about all facets of instruction, it is not possible to provide instructional leadership to an entire faculty. It is crucial that school administrators be educated in all areas of instruction for all ability levels of students to be able to provide support in instruction.

Stiggins and Duke (2008) stress the need not only for instructional leadership but for assessment leadership. They believe that many principals and other school leaders are not provided the appropriate coursework in leadership preparation programs to allow them to guide teachers in the use of quality assessment techniques. Teachers are often left to either create their own materials with little or no guidance or use published materials that may or may not be appropriate. School leaders should become experts on assessment and should use that expertise to help teachers better utilize assessment tools and data for improvement of instruction (Stiggins & Duke, 2008).

While it is easy to blame the school principal for a school's lack of success,

perhaps the school district should examine its role in student achievement. Burch (2007) found that many school principals were working diligently in very productive ways to improve their schools, while the school district leaders were working in contradictory ways, often interfering with the success of the school. Burch suggests that school system administrators should reexamine their roles and how their work can enhance the work of the principal in reform efforts. Like the principal, the district level leaders should also view themselves as instructional leaders, providing coaching and learning opportunities for school level leaders to increase their capacity to grow as school level instructional leaders (Burch, 2007).

For a principal to become an instructional leader, Halawah (2005) states that it is crucial that he or she systematically visits every area of the school on a daily basis and becomes familiar with every activity occurring in the building. This heightened sense of the entire school program will allow the principal to be better prepared to deal with instructional issues and provide leadership in areas such as instruction (Halawah, 2005). Blase and Blase (1998) stress that, to be an effective instructional leader, it is important to provide support and be visible in classrooms without interrupting instruction. Allow the teacher autonomy in teaching strategies while upholding high standards and expectations. There should be a delicate balance between providing support and allowing the teacher the freedom to do his or her job (Blase & Blase, 1998).

To be effective leaders in schools, it is essential that administrators view their position as one directly related to the quality of instruction students receive on a daily basis. High standards should be upheld consistently for all faculty and staff. To be able to provide instructional leadership, a solid foundation in best practices and curriculum is

crucial to be able to judge the quality of the work taking place in the school. Continual training and research on new theories in instructional methods and strategies should be available for both instructional leaders and faculty members to ensure the best possible resources are used in classrooms.

### *Change Implementation in Schools*

Typically in education, change is mandated from the federal government, state department of education, local school board, or school system central office. It is less common to have grass roots reform efforts that begin at the school level, however, Hopkins and Higham (2007) suggest that, for a change to be effective and lasting, it needs to be embraced and owned by the teachers in the school. They believe that teachers should be given leadership roles to actively participate in new initiatives, allowing them to shape the culture within a school to prepare the faculty to implement the new ideas. Teachers view the change as important, and they take ownership of the process and end result (Hopkins & Higham, 2007). The problem, according to Bascia and Hargreaves (2000), is that teaching is a complex task that is not easily changed with a mandate from reformers with little connection to education. Often, those who design and require change in education do not account for necessary resources, time, or professional learning opportunities for teachers (Bascia & Hargreaves, 2000). Change should be well planned, with the site prepared, faculty in place, staff trained and ready, and a plan for adjusting as needed throughout implementation (Kratowill, Volpiansky, Clements, & Ball, 2007).

In Ontario, Winter and McEachern (2001) tracked a massive shift in educational curriculum and materials, noting that teachers appear to be quite discontent with the

change. They believe the teachers, who were not involved in the decision to change the curriculum, did not feel as though they were viewed as competent professionals. To remedy this, the province educational leaders could have used their expertise throughout the decision-making process to encourage the teachers to embrace the change (Winter & McEachern, 2001).

The manner in which teachers view themselves as professionals may also affect the extent to which they participate as change agents in a school. Sebring, Allensworth, Bryk, Easton, and Luppescu (2006) found in the Chicago Public School System that teachers were more likely to participate actively in change if they were empowered by the school administration to believe they could positively affect the school. Typically, this begins with the leadership encouraging innovation and supporting teachers as they try new things in their classrooms and beyond in the school (Sebring, Allensworth, Bryk, Easton, & Luppescu, 2006).

#### The Literature as It Relates to This Study

The key topics that emerged in the literature review greatly influenced the situation at the middle school in this study. There was apprehension regarding AYP accountability and student performance on the new high-stakes test that was to be based on the recently introduced and implemented performance standards. The state required the new standards with little guidance and professional development for teachers, and the math textbook adoption for the state was still two years away. The train the trainer model for professional development did not allow all of the teachers to experience the same information, resulting in a trainer who had limited interaction with the new skills attempting to guide peers who were very resistant to the new change. With instructional

materials that did not match the curriculum and instruction left open to interpretation, teachers were not sure whether to implement the new standards or return to what was comfortable, the previous standards. One teacher, the trainer, decided to try the new standards, while the other two did not. This study will show whether the test was correlated with the new performance standards by comparing the performance of the two groups of students. The students who were taught the new standards should have significantly higher scores than those who were taught the curriculum that no longer was aligned to the state test.

### Summary

There is an abundance of literature supporting the need for better mathematics education in the United States, though there is no definitive way to improve. There are, however, many theories on factors that affect the quality of education students receive. A rigorous curriculum taught by well-trained teachers and supported by a meaningful assessment program should yield results according to the previous research. This study gave insight into one school's experience in implementing a mandated curriculum and participating in the corresponding high-stakes test.

## CHAPTER THREE: METHODOLOGY

### Overview of the Study

The Georgia Department of Education mandated a new mathematics curriculum beginning in sixth grade during the 2005-2006 school year. The new performance-based curriculum focused more on higher-order thinking skills, with a strong focus on application of concepts. The previous curriculum required drilling basic skills with little connection to real life. The state department of education did not plan well for implementation and only provided training for one teacher per school system who was then expected to train all other teachers in his or her system. The implementation also did not coincide with the textbook adoption cycle, leaving teachers to create their own materials with outdated textbooks that were not aligned to the new standards.

In the rural district in this study, the teacher sent to the state training redelivered the materials and information to her colleagues and attempted to create teaching materials and lessons that aligned to the new standards. The other two teachers in her grade level attended the trainings but decided that they were not going to teach the new standards in their classrooms. When questioned about this decision, they responded that they believed that the end-of-year high-stakes test would not yet be aligned to the new standards. The teacher who attended the training worked all year to ensure that each lesson and activity aligned to the new curriculum, while the other two teachers continued with the lessons they taught in previous years, drilling basic skills.

At the end of the school year, the students' test scores appeared to reflect the teacher practices. Those in the treatment group who received the new curriculum scored

higher than those in the control group that only drilled basic skills. While there seemed to be a substantial difference in the performance of the two groups of students, more analysis was needed because the treatment group contained most of the gifted students in that grade level, who might be expected to perform on a higher level. This study attempted to determine if the difference in the scores of the two groups can be attributed to the curriculum implementation or if it is merely a result of student ability grouping.

The purpose of the study was to determine if providing the state-mandated sixth grade mathematics curriculum to students helped them score higher on the Georgia Criterion-Referenced Competency Test (CRCT) than those students who did not receive the correct curriculum. The students in the study were divided into two groups: Those who were taught the curriculum (treatment group) and those that were not (control group). The students who were taught the state-mandated curriculum should have scored higher on the state summative assessment than those students who were not taught the state curriculum as long as the test was aligned to the new standards.

The study attempts to answer the following question:

Did the year-end assessment in the state of Georgia in mathematics in the spring of 2006 reflect the new mandated curriculum as evidenced by a disparity between the scores of the students taught the new curriculum and those taught the outdated curriculum?

In addressing the research question, the study retained or rejected the following hypothesis:

There will be no significant difference between scores of groups of students that used the specially designed curriculum as compared to those using the old curriculum as



indicated by the results of the Georgia Criterion-Referenced Competency Test (CRCT). Discussion will vary based on the rejection or retention of this hypothesis. If the hypothesis is retained due to a lack of evidence of disparity between the scores of the two groups, issues of curriculum and assessment alignment should be examined. Rejection of the hypothesis due to a significant variance in the scores of the two groups will support the state's testing program as a measure of the taught curriculum and will further support research on the importance of instructional leadership.

### Design of the Study

The causal-comparative study compared test scores of two groups of students to determine if access to the state mandated curriculum resulted in better performance on Georgia's Criterion-Referenced Competency Test (CRCT). Two score sets were used for each group, the fifth grade test scores (pre-test) and the sixth grade scores (post-test) to allow for differences in student ability between the groups. Analysis of covariance (ANCOVA) was used to determine if the treatment (new curriculum) provided one group enabled those students to outperform the students who did not receive the treatment (control group).

### *The Research Participants*

The rural middle school in the study is the only middle school in a small district that also only included one high school. Three elementary schools feed into the middle school, so students have varied experiences coming into the middle school setting. At the middle school, they are scheduled in a manner that heterogeneously combines students from all three elementary schools.

There were three teacher participants who all taught sixth grade math during the

2005-2006 school year. The treatment group teacher, who was nearing the end of her career, had no intentions of retiring and was still an enthusiastic, child-centered teacher. One control group teacher was in her final year of teaching and had plans to retire at the end of the year, and the other control group teacher was mid-career and had intentions of changing school districts at the end of the year.

The student participants for the study consisted of 240 students who were in sixth grade during the 2005-2006 school year. The control group (the students who did not

Table 3.1

*Ethnicity*

	Treatment Group (New Standards)	Control Group (Old Standards)
<b>Ethnic Breakdown</b>		
Asian	1%	1%
Black	0%	3%
Hispanic	10%	5%
Multiracial	4%	1%
Native American	0%	1%
White	85%	89%

receive the new curriculum) involved 158 students, and the treatment group (who were taught the new curriculum) contained 82 students. The sample included every general education and special education student who was taught math in a general education setting and took the fifth grade CRCT in the spring of 2005 and the sixth grade CRCT in

the spring of 2006. Students who did not have test scores for both years were excluded from the study as well as students who were in resource special education math courses. The treatment group contained more high-level students, but the use of the pre-/post-comparison helped adjust for this difference.

The make-up of each group by ethnicity, in Table 3.1, demonstrates the lack of diversity school-wide. Both groups contained predominantly white students with only a

Table 3.2

*Demographic Information*

	Treatment Group (New Standards)	Control Group (Old Standards)
Total Number of Students	82	158
Gender	Male: 40%	Male: 48%
	Female: 60%	Female: 60%
Students with Disabilities	5%	9%
Students Gifted in Math	37%	3%

few or no students representing each of the other ethnic groups. Where the two groups varied from each other was in the number of students identified as gifted or special needs. Note in Table 3.2 that the number of gifted identified students in the treatment group was substantially higher than the control group. This was due to the practice of scheduling most (but not all) of the gifted students in classes together, along with students who do not meet the gifted criteria. None of the math teachers participating in this study were

certified to teach gifted courses, but one teacher (the one for the treatment group) taught on a team that included most of the gifted students for that grade level.

#### Data Gathering Methods

Student information was exported from the school system student information system, grouped by teacher, with demographic information to include gender, ethnicity, and enrollment in gifted and/or special education. Demographic information was charted for the study to provide a detailed description of the participants. Test scores for the 2005 test and the 2006 test were added to the file, and once students were in the appropriate group, demographic information was removed. Permission to use the information was provided by the school's principal, and confidentiality was maintained at all times for the individual students and the school.

To describe the way the curriculum was delivered to the groups of students, interviews were used. The teacher who delivered the new curriculum and was supposed to train the other two teachers to do the same gave her account of what happened in her own classroom and shared her memories of the conversations that occurred while training the other two teachers to deliver the new content. She was asked to describe her training sessions, including her recollection of comments made by the other two teachers with regards to the new curriculum. She stated that the other two teachers refused to teach using the new standards, believing that the state would not be able to alter the CRCT enough to match the new curriculum by the end of the year. They felt as though they were preparing students better in math using the old curriculum because the old standards focused more on basic skills, while the new curriculum focused on performance and

projects. The control group teachers did not see the value of the new standards and chose to teach the same way they had in previous years.

The administrators who conducted observations in all three classrooms during that time provided their recollections of classroom observations and conversations held with all three teachers before, during, and after content delivery and CRCT testing. Notes used from the administrator classroom observations were also examined to ensure accuracy of thoughts and triangulation of information. While the information from the interviews and documents were used to describe classroom practices, there was no statistical analysis of this information.

Administrator interviews revealed the same information as the interview with the treatment group teacher. The treatment group teacher embraced the new curriculum and worked daily to make sure her students were taught as the state mandated, while the control group teachers continued teaching the old standards with the textbook that no longer aligned with the mandated curriculum. The control group teachers, when questioned about their classroom practices by administrators at the end of the 2006 school year, stated that they did not believe the state would have an assessment prepared to measure the new curriculum.

To gather information about classroom practices, interviews were held with school administrators who conducted observations in sixth grade math classes during the 2005-2006 school year and with the teacher who was sent to the state training and was responsible for providing training to the other two teachers. These interviews were informal and were conducted by the researcher. All participation was voluntary, and confidentiality will be maintained throughout the study and subsequent publication.

Documents examined to ensure verbal accounts of the events during that school year matched the written record included scripted notes from administrator observations and records of formal observation documentation. Three of the four administrators who were at the school during the 2005-2006 school year are still working for the school and have maintained records from all observations. This documentation helped provide a picture of what occurred in the three classrooms during that school year. They showed project-oriented, higher order thinking tasks in the treatment group's classes and drilling of basic facts and recall type activities in the control group classes. The treatment group teacher abandoned the textbook completely, while the control group teachers continued to teach from the same outdated text used for the old standards.

#### Instrumentation

The instrument used to measure student achievement was the Georgia Criterion-Referenced Competency Test (CRCT). The data came from the mathematics section of the high-stakes, multiple-choice test required for Georgia students in April of each year. The test acts as a summative assessment, measuring mastery of the Georgia Performance Standards (the required curriculum in the state of Georgia). The Georgia Department of Education uses the test to gauge the quality of education at the individual, classroom, school, system, and state levels (Criterion-Referenced, n.d.).

The CRCT given to students in the spring of 2006, according to the state department of education, was aligned to the new GPS standards. A quantitative study was conducted by the testing company that included a review of all test items (990 for sixth grade math) to ensure they aligned with a standard in the new curriculum. After the testing company's review was complete, they invited a panel of Georgia educators to

review items for appropriateness, alignment to standards, quality, and bias; this group, however, was only given 30 items to review (2006 GA CRCT Technical Report). At this point, the testing company and state department determined that the test was valid to use as a measure of student mastery of the new GPS curriculum. At a minimum, the instrument can be said to possess content validity.

Reliability for the CRCT was also calculated using the Coefficient Alpha on the Rasch ability metric. For sixth grade math, the reliability for the 2006 test was calculated at .90 (2006 GA CRCT Technical Report), while the 2005 test also had a .90 reliability (2005 GA CRCT Technical Report). According to these statistics, the tests should be reliable measures of student performance.

#### Sampling Procedures

For this study, random sampling was not possible due to the fact that students had already been placed in classes. This school utilized ability grouping, which is why most the gifted students were placed with one math teacher. It was recognized that this lack of randomization in the sample could create problems, so statistical and sampling procedures were utilized to minimize these problems.

#### Data Analysis Procedures

This causal-comparative study compared two groups of students: The students who received the curriculum based on the new standards (treatment group) and the students who were taught the old standards (control group). The independent variable for the study was the curriculum that was used, and the dependent variable was the students' scores on the state criterion-referenced test at the end of the 2006 school year. The hypothesis for the study was that there will be no significant difference between scores of

groups of students that used the specially designed curriculum as compared to those using the old curriculum as indicated by the results of the Georgia Criterion-Referenced Competency Test (CRCT).

Once the student scores were compiled from historical data for the two years (2005 scores for the pre-test and 2006 scores for the post-test), an analysis of covariance (ANCOVA) was conducted to determine if the performance difference between the groups was statistically significant. This was an appropriate test because the scores of the two groups were not normally distributed and the pre- and post-tests were based on two separate score scale ranges (Howell, 2008). If the results of the ANCOVA showed that the difference was not significant, the hypothesis would be retained. If there were a statistically significant difference in the performance of the two groups, the hypothesis would be rejected.

When the test was created for the 2006 school year, it was to be aligned to the new curriculum. The state testing department created the new scale range to prevent comparison of the scores since the test was based on an entirely different curriculum. The ANCOVA allowed for this difference in score ranges by using the fifth grade test as a pre-test for all students that was not directly compared to the post-test score. Instead, the pre-test was held as a constant, or covariate, for students, and the effect of the treatment was considered after controlling for the covariate.

The causal-comparative study examined two groups using a non-equivalent group pretest-posttest design. Because of the disparity between academic ability of the students in each group, raw scores were not directly compared between the pre- and post-tests. Pre-test scores for the groups were used as covariates in determining significance of the



gains demonstrated by each group. In addition, because of the difference in percentage of gifted students in each group, it was determined that comparisons should be run in two ways. The first ANCOVA was run with all students in the sample included, and a second ANCOVA was run with all of the gifted students excluded. It was not known at the time whether the higher ability levels of the gifted students might give them an advantage in testing, or whether the potential for a test-ceiling effect might present them with a disadvantage in gains from the pretest the posttest.

#### Summary

The study examined test scores of two groups of sixth grade students, the treatment group that was taught the new, state-mandated curriculum, and the control group that was taught the previous curriculum. The students' fifth grade scores were used as a pre-test to minimize differences in ability levels of students in the groups. By using an analysis of covariance (ANCOVA) to consider the pre-test scores as factors for each group, it was possible to examine the sixth grade test scores and determine if being taught the new curriculum had an effect on the students' performance. The students who received the state-mandated curriculum were expected to perform at a higher level than those that were not exposed to the new standards. If there was a statistically significant difference in the performance of the two groups, this study will support the literature that stresses the importance of instructional leadership in schools. If there was not a significant difference between the two groups, issues of alignment of curriculum and assessment should be addressed.

## CHAPTER FOUR: FINDINGS

### Purpose of the Study

This study utilized a causal-comparative design to determine if following the state mandated curriculum in sixth grade mathematics in the state of Georgia during the first year of required implementation enabled students to better perform on the high-stakes, end-of-year criterion referenced test (CRCT) for that subject area. During the 2005-2006 school year, the Georgia Department of Education required that schools teach the new Georgia Performance Standards, a more rigorous, hands-on, integrated math curriculum, to sixth grade students. In the rural school in this study, one teacher chose to embrace the new standards, while the other two teachers chose to continue teaching the previous curriculum. The two groups were examined in this study, including one that was taught the new curriculum and one that was not given access to the new curriculum. The hypothesis was that there would be no difference in the performance level of the students taught the new curriculum (treatment group) when compared to the students taught the old curriculum. The information from the data analysis gave insight into curriculum implementation practices, curriculum and test alignment, and the value of instructional leadership in schools.

Figures 4.1 and 4.2 demonstrate the need for this study. It appeared from the charts that there was an obvious difference between the performance scores of the two groups, though neither group performed well on the 2006 test. Because of differences in ability levels between the two groups, statistical analysis was required to determine growth on the test. The question this study attempted to answer was whether the

Figure 4.1

*Student Performance Levels on CRCT for Control Group*

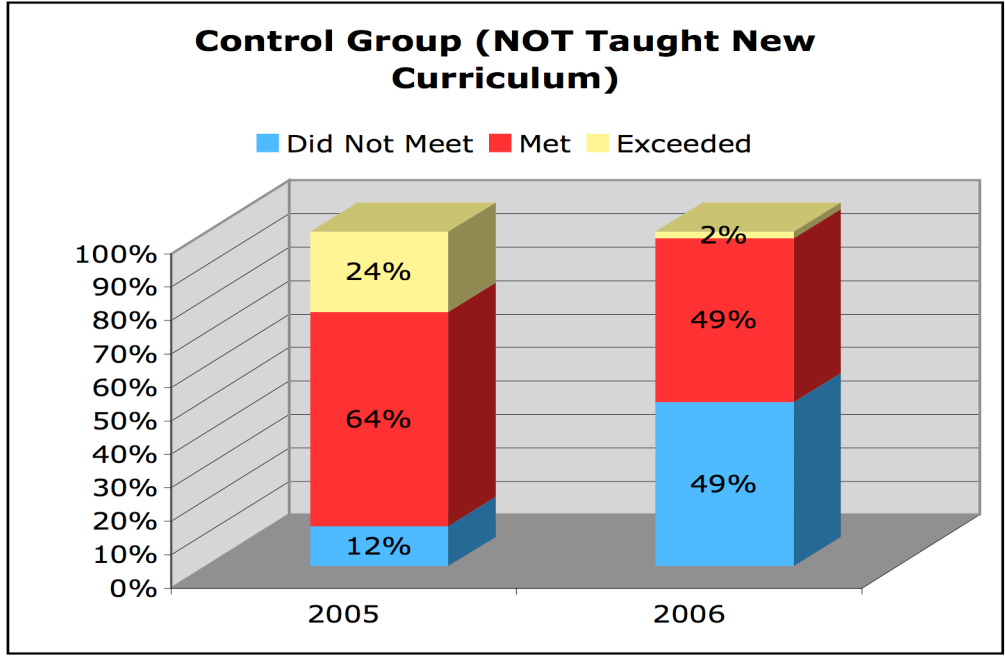
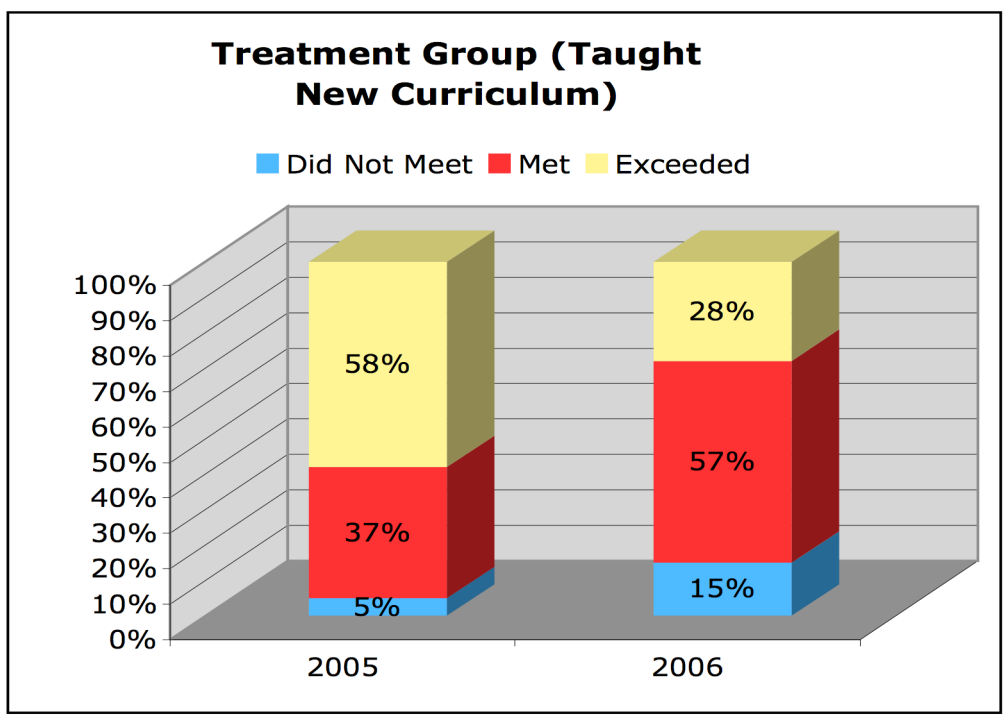


Figure 4.2

*Student Performance Levels on CRCT for Treatment Group*



difference between the two groups was significant enough that it could not be a product of chance after controlling for differences in the groups demonstrated in an examination of pre-test scores.

The study examined the following hypothesis:

There will be no significant difference between scores of groups of students that used the specially designed curriculum as compared to those using the old curriculum as indicated by the results of the Georgia Criterion-Referenced Competency Test (CRCT). Examination of the data using the appropriate statistical test allowed the hypothesis to either be retained or rejected based on the difference in test scores of the two groups when controlling for differences in student ability level, as measured by a pre-test.

#### Interview and Document Review

Determining what happened in math classrooms in the rural middle school in this study was possible through interviewing the treatment group teacher, who was responsible for training the other two teachers on the new curriculum, and by examining documents from classroom observations conducted by administrators during the 2005-2006 school year. The information collected from the interview and document review was used to tell the story about what happened that year and justify grouping students into treatment and control groups.

The informal interview was conducted with the teacher who was the school trainer for the Georgia Performance Standards (GPS), Georgia's new curriculum. She was responsible for attending the state training sessions and redelivering the information to the other two math teachers in her grade level. According to her, the teachers attended her training sessions and attempted to implement the new curriculum for the first two

weeks of school. After that, they attended training sessions reluctantly but told the trainer that they would not implement the curriculum in their own classrooms because they did not believe the CRCT at the end of the year would be changed to represent the new standards. There also were no textbooks available that matched the new curriculum, and they were not willing to stray from textbook teaching to create their own performance-based activities. The trainer continued to conduct training sessions with the teachers, but she knew they were not using the new strategies and concepts in their classrooms. She decided to continue with the new curriculum despite the lack of cooperation from her colleagues.

A review of documents from classroom observations that year gave insight into the classroom practices. The three administrators who conducted classroom observations that year scripted classroom events while conducting formal observations. A review of these scripted notes revealed that the treatment group was immersed in the new curriculum, learning through performance-based activities that involved more higher-order thinking tasks and fully aligned to the new integrated curriculum (concepts of algebra, geometry, and data analysis infused with basic math skills). The teachers of the control group relied solely on the textbook that was not aligned to the curriculum, focusing on drilling basic math with little reference to algebra, geometry, or data analysis. Activities, including assessments, in these classrooms were straight from the textbooks, with no performance tasks to connect content to real life or any other subject area.

The information gathered from the trainer and from the review of classroom observation documents clearly painted a picture of classroom practices for the 2005-2006 school year. The teacher of the treatment group wholeheartedly embraced the new state

standards and worked daily to implement them, while the control group teachers rejected the new curriculum to drill basic math facts, hoping that the end-of-year test would not match the new curriculum. This information justified grouping students into the treatment and control group for the purpose of this study.

### The Data

When the Georgia Department of Education introduced the new CRCT, they purposely used a different range of scale scores to prevent inappropriate comparisons from being made between the tests that measured two separate curriculums. Using the appropriate statistical analysis, it was possible to compare the two groups using a pre-/post-test comparison where the fifth grade scores were not compared directly to the sixth grade scores but were used in a formula as a covariate to provide information about each group of students.

Another issue with comparison of the two groups was the academic ability of the students in the groups. The group that was exposed to the new curriculum contained most of the gifted identified students for that grade level, students that were expected to perform at a higher level. To avoid making inappropriate comparisons between two groups that had different ability levels, the fifth grade scores were used to lessen the effect of student ability on the data.

Student scores were collected for all students who had scores from the sixth grade test in 2006 and the fifth grade test in 2005. Any students who did not have two years of data were excluded from the study. Also excluded were special education students who were taught math in resource classes due to individual education plans (IEP) that sometimes require a modified curriculum.

Students were grouped into control and treatment groups based on the curriculum they received. The treatment group was taught the new curriculum, while the control group was taught the outdated standards. Table 4.1 shows the scale score range used for each test, and Table 4.2 gives the sample size and mean for each group and each test. There appeared to be a large disparity between the test scores of the treatment and control groups, with the difference widening on the post-test scores. This study explored that disparity and provided information to determine if there was a statistically significant variance in performance between the two groups.

Table 4.1

*Scale Score Ranges for the CRCT*

	Scale Score Range	
	2005	2006
Performance Level		
Did Not Meet Standards	150-299	650-799
Met Standards	300-349	800-849
Exceeded Standards	350-450	850-950

In examining the mean for each group in Table 4.2, the pre-test (fifth grade test) scores for the treatment group, on average, were at a level that fell in the “exceeded standards” performance level, while the control group “met standards”. For the post-test, the treatment and control groups both performed at the “met standards” level.

To determine if the difference between the two groups was statistically

significant, an analysis of covariance (ANCOVA) was conducted with the post-test (sixth grade scores) as the dependent variable, the pre-test (fifth grade scores) as the covariate, and the group assignment (treatment or control) as the independent variable. By using an

Table 4.2

*Summary Statistics*

	n	Mean	Standard Deviation	Median	Range
<hr/>					
Treatment					
Pre-Test	82	350.39026	31.739199	350	169
Control					
Pre-Test	158	330.25317	25.04364	329	120
Treatment					
Post-Test	82	830.03656	28.824478	835	121
Control					
Post-Test	158	801.8418	20.644249	800	102
<hr/>					

ANCOVA, it was possible to use the fifth grade scores to equalize differences in ability levels of the two groups to allow for a more appropriate comparison of the post-test scores.

The ANCOVA yielded the results in Tables 4. 3and 4.4. The pre-test row of the Table 4.3 gave power to the study by demonstrating that the pooled slope was not equal to zero. The regression effect was significant,  $F(1, 237) = 335.649, p < .0005$ .

The Group statistics gave the effect of the new curriculum, or treatment, on the post-test scores after removing the effects of the pre-test, or covariate. The results were significant



Table 4.3

*Results of Analysis of Covariance (ANCOVA)*

Between Subjects Factors				
Group	N			
Treatment	82			
Control	158			

Tests of Between-Subjects Effects				
-----				
Dependent Variable: Post-Test				
Source	df	Mean Square	F	Sig.
Corrected Model	2	60789.464	259.378	.000
Intercept	1	539150.504	2300.456	.000
Pre	1	78665.013	335.649	.000
Group	1	10664.268	45.502	.000
Error	237	234.367		.000
Total	240			.000

a. R Squared = .686 (Adjusted R Squared = .684)

with  $F(1,237) = 45.502$ ,  $P < .0005$ . Table 4.4 shows the adjusted post-test scores after accounting for differences using the pre-test. For the purpose of this study, the difference in scores between the treatment and control groups was significant when adjusting for the effect of the pre-test scores, causing the rejection of the hypothesis.

Table 4.4

*Adjusted Post-Test Scores*

Group	Adjusted Post-Test Score
Treatment	820.465
Control	806.522

While the statistical results were clear, there were many factors that could have affected the scores. Foremost of those factors was the difference in ability levels of the groups involved, especially shown by the percentage of gifted students in each group. For that reason, a second ANCOVA was run after excluding the scores of all of the students gifted in math. Essentially, students classified as gifted were treated as outliers for statistical purposes.

Summary statistics for the groups once students gifted in math were excluded are shown in Table 4.5. The pre-test scores and post-test scores for both groups were in the “meets standards” scale score range; however, the difference in mean scores between the groups widened with the post-test. The ANCOVA was conducted to determine if this difference was statistically significant enough that it could not have occurred by chance alone.

Table 4.5

*Summary Statistics Excluding Students Gifted in Math*

	n	Mean	Standard Deviation	Median	Range
<hr/>					
Treatment					
Pre-Test	52	335.5	24.773088	337.5	109
Control					
Pre-Test	154	329.33118	24.620533	329	120
Treatment					
Post-Test	52	817.3077	26.9855	818.5	108
Control					
Post-Test	154	800.8182	19.735325	799	102
<hr/>					

The ANCOVA that excluded the students gifted in math yielded the results in Tables 4. 6 and 4.7. The pre-test row of the Table 4.6 gave power to the study by demonstrating that the pooled slope was not equal to zero. The regression effect was significant,  $F(1,203) = 27.169$ ,  $P < .0005$ . The Group statistics gave the effect of the new curriculum, or treatment, on the post-test scores after removing the effects of the pre-test, or covariate. Table 4.7 shows the adjusted post-test scores after accounting for differences using the pre-test. For the purpose of this study, the difference in scores between the treatment and control groups was significant, with the students gifted in math excluded, when adjusting for the effect of the pre-test scores, causing the rejection of the hypothesis.

Table 4.6

*Results of Analysis of Covariance (ANCOVA) Excluding the Students Gifted in Math*

Between Subjects Factors				
Group	N			
Treatment	52			
Control	154			

Tests of Between-Subjects Effects				
-----				
Dependent Variable: Post-Test				
Source	df	Mean Square	F	Sig.
Corrected Model	2	31225.355	141.335	.000
Intercept	1	393350.649	1780.414	.000
Pre	1	51880.774	234.827	.000
Group	1	6002.443	27.169	.000
Error	203	220.932		.000
Total	206			.000

a. R Squared = .582 (Adjusted R Squared = .578)

Table 4.7

*Adjusted Post-Test Scores Excluding the Students Gifted in Math*

Group	Adjusted Post-Test Score
Treatment	814.325
Control	801.825

## Summary

Two groups of student test scores were analyzed using an analysis of covariance (ANCOVA) to determine if being taught the state-mandated curriculum yielded higher results on the year-end high-stakes test, the Georgia Criterion-Referenced Competency Test (CRCT). To eliminate effects of scheduling and ability grouping for the students, pre-test scores were used from the spring of the students' previous school year as a covariate. By minimizing the effect of student ability, it was possible to consider the effects of the treatment (exposure to the curriculum) while minimizing the effect of scheduling students by ability.

The results indicated that the treatment effect was significant and that the difference in scores between the two groups of students probably did not occur by chance. Based on the data, the hypothesis, that there would be no significant difference in student scores between the two groups, was rejected.

Because of the large percentage of students identified as gifted in math in the treatment group, another ANCOVA was conducted that excluded these gifted students to determine if the original results could be a factor of the gifted students being motivated

and able to learn regardless of the instruction they received. Even with these students excluded, the results were statistically significant enough to reject the hypothesis that there would be no significant difference in student scores between the two groups.

The results of both analyses, one including all sixth grade students and one excluding the students gifted in math, show a substantial difference in scores between the test performance of the treatment and control groups. Chapter five contains a detailed discussion and future implications for this study.

## CHAPTER FIVE: SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

### Summary

#### *Introduction*

During the 2005-2006 school year, the Georgia Department of Education required a new math curriculum, the Georgia Performance Standards (GPS), beginning in sixth grade. The new standards were much more rigorous, required hands-on experiential learning, and integrated math content such as algebra, geometry, and statistics. With the paradigm shift in teaching methods and content, there were few materials available for teachers, as the textbook adoption cycle in the state did not allow for the purchase of new materials until two years after the new curriculum was mandated.

Assessment is crucial to the success of any educational program to determine if students are mastering the content. Georgia's Criterion-Referenced Competency Test (CRCT) was amended in the year of new curriculum implementation to reflect the new content, with questions requiring higher order thinking skills students were expected to acquire through interactive learning experiences required by the GPS. Throughout the state, test scores fell in the first year of implementation as teachers struggled to teach with few resources, and students attempted to learn in a very different way. This study gives an account of one school's experience with implementation and shows the effect of teacher practices on student high-stakes test scores.

The rural school in this study had three sixth grade regular education math teachers for the 2005-2006 school year. One of the teachers attended the state training sessions on the new curriculum and was responsible for training the other two teachers.

While the training did occur, the other two teachers refused to implement the new content and teaching practices in their classrooms. They believed the state would not have the CRCT aligned to the new standards at the end of the year. All three teachers were professional, experienced educators that worked hard each day to ensure their students were successful. In this case, the two teachers who refused to teach the standards truly believed their decision was what was best for their students. There was no malicious intent. While the teacher who attended the state training fully implemented the new standards in her classroom, the other two teachers continued to teach the previous curriculum.

#### *Purpose*

At the end of the 2005-2006 school year, student test scores appeared to reflect classroom practices in implementing the new curriculum. The students who received the new curriculum outperformed the students who had no access to the new standards. It was easy to conclude that teaching the standards was crucial to student success on the test until differences in the ability levels of the groups of students were examined.

At the time of this study, students were ability grouped in the sixth grade. Students enrolled in the gifted program and those identified as high achieving students were placed on one team, students considered average were on another team, and those who were labeled “at-risk” of failure were placed on a separate team. The teacher who embraced the new standards taught the team that contained all of the gifted and high achieving students, while the other two teachers had all of the students considered average and at-risk.

Because of the difference in student ability between the groups, it was necessary



to examine the data more deeply to determine if the performance difference between the two groups was a product of ability or of exposure to curriculum. This study attempted to control for differences in ability level between the two groups to determine if the variation in scores was attributed to the curriculum the students received. The data was used to discuss implications of teaching practices on student test performance.

### *Participants*

The students in the rural middle school were not diverse racially or ethnically, however, they varied greatly in socioeconomic status, academic ability, and previous achievement. Over 89% of the school population was white, 5% Hispanic, 3% black, 1% Asian, 1% multiracial, and 1% Native American. Economically, students varied greatly, with about 40% of the school population falling in the upper middle class range, and approximately 60% of the students living below the poverty line. School-wide, about 12% of students were in the gifted program, and 13% were in special education.

The groups of students in this study varied in ability level and participation in the gifted program and special education. The treatment group (received the new standards) had a make-up that included 5% special education students and 26% gifted students, while the control group (did not receive the new standards) had 9% special education students and only 3% gifted students. This disparity in group membership and ability was the reason for a closer look at the data to determine if ability was the cause of the test score difference. By isolating ability level, it was possible to examine the growth of each group with teaching practices as the main difference for the groups.

### *Methods*

Student information was gathered from the school's student information system,

and test scores for the 2005 and 2006 school years were added. Any student missing test scores for either year was excluded from the study, as were special education students who were not taught in the regular education math class. Students were grouped by treatment and control based on the curriculum they received. The treatment group consisted of 82 students, and the control group contained 158 students.

Once demographic information was compiled for each group of students, the test scores were analyzed using an analysis of covariance (ANCOVA) with the pre-test scores (2005 scores) as the covariate and the post-test scores (2006 scores) as the dependent variable. By using the pre-test as a covariate, it was possible to reduce the effect of student ability level on the data. A second ANCOVA was conducted that excluded all students identified as gifted in math to determine if the same difference in scores existed with groups that were more similarly matched by student ability.

#### *Results of Research Question*

Did the year-end assessment in the state of Georgia in mathematics in the spring of 2006 reflect the new mandated curriculum as evidenced by a disparity between the scores of the students taught the new curriculum and those taught the outdated curriculum?

Without reading the test in concert with the curriculum, it was impossible to definitively answer this question; however, given the results of the study, it appeared as though the test did measure the appropriate content. If the test did not match the curriculum, there would have been a less significant difference in the scores of the two groups. If the test had not been changed and was still correlated to the previous curriculum, the students in the control group would have scored much higher. Since the

state department of education will not release the test items for review, studies such as this are the only way for those in education to measure the value of the test.

There was a disparity between the two groups as measured by the ANCOVA. After controlling for the ability level of the students by using the pre-test as a covariate, the scores of the students on the post-test were significantly different. Those students who were exposed to the new curriculum outperformed those who were taught the previous standards by a sizable margin. The same finding occurred even when the “gifted” factor was controlled for (by eliminating scores of gifted students in all groups).

Gifted students were excluded for the second ANCOVA because many of them are able to perform well on standardized tests regardless of the instruction that occurs in the classroom. They are typically more motivated and tend to learn the material on their own out of intellectual curiosity. To alleviate the effect of their motivation and intuitive nature in answering test items, they were excluded as outliers to give a better picture of the performance of the groups with less variance in student ability level.

The second ANCOVA also excluded the gifted students to lessen the ceiling effect of these students’ scores on the data. When students score at or near the top of the scale score range, it is difficult, or even impossible, to show growth the following year. Often the results of the gifted students appear to drop from year to year simply because there is so little room for improvement in their scores. A student who receives a perfect score cannot show growth the following year; the best he or she can do is maintain the perfect score, resulting in data that does not accurately correspond to the students’ ability to perform on a higher level, hence, the ceiling effect. By excluding these students from

the second ANCOVA, the ceiling effect was controlled, allowing for data that accurately represented growth, or lack thereof, for most students.

### *Hypothesis*

The hypothesis examined for the study was:

There will be no significant difference between scores of groups of students that used the specially designed curriculum as compared to those using the old curriculum as indicated by the results of the Georgia Criterion-Referenced Competency Test (CRCT). Because the scores of the two groups varied significantly using the ANCOVA with the pre-test scores as the covariate to control for student ability, this hypothesis was rejected. There was a significant difference between the scores of the two groups of students who were taught two different curriculums.

Because the teacher of the treatment group fully embraced and implemented the new curriculum exactly according to the state training, it is feasible to state that the test did appear to assess the appropriate standards. Those students exposed to the new standards were better prepared for the test than the students in the control group classes.

### Discussion

It seems obvious that students taught the appropriate curriculum would perform better on a high-stakes test correlated to that curriculum than students who were taught something else. However, there are not many studies that have examined the relationship between the taught curriculum and student performance on state-mandated standardized tests. This study attempted to give information about that relationship in the state of Georgia during the first year of math curriculum implementation in sixth grade.

The treatment group teacher attended all state training sessions and fully embraced the new standards, working long hours each day to plan performance-based learning experiences for her students. The control group teachers, though they received the state materials and training, chose to teach the previous content, believing that the state would not be able to prepare a year-end test to assess the new standards. All of the teachers involved provided high-quality math instruction in their classrooms, but the curriculum was different for two classes of students.

Because the students were of varying abilities in each class, it was necessary to account for these differences by using a pre-test. Scores from the students' fifth grade CRCT were used as a covariate to reduce the effect of ability level on the data. After controlling for ability level of the students, the post-test scores, the scores from the students' sixth grade CRCT, were analyzed to determine if a difference existed between the two groups of students.

The data showed a significant difference in the scores of the groups of students. The treatment group who was taught the new curriculum outperformed the control group significantly, causing rejection of the null hypothesis that the scores of the groups would not be statistically different. The results were the same even with the students gifted in math excluded from the study. The conclusion is that students in sixth grade math in the state of Georgia must be taught the state-mandated standards to be able to perform well on the CRCT.

Because the test appeared to measure the appropriate curriculum, Scott's (2001) definition of the purpose of standardized testing holds true in this case, that standardized tests should be representative of a specific body of knowledge allowing inferences to be

made about a student's content mastery. Because the group taught the Georgia curriculum performed higher than the group who was taught the previous curriculum, inferences were made about student mastery of the content contained in the new standards. Parke and Lane (2008), in studying Maryland's assessment program found that the state standardized test was closely aligned with the mandated curriculum; however, teacher assessment practices did not align so well. In the case of the school in this study, it may be helpful for the teachers to be trained in proper assessment techniques and for the school or system to assist them in designing common assessments across subject areas that align more fully with the curriculum students are expected to master.

Popham (2001) believes that assessment of any kind should be used for the purpose of examining what students have learned and adjusting teaching practices based on the assessment data. For the school in this study, the formative assessment showed that one group of students was able to perform satisfactorily when assessed on the new curriculum content, while the other group did not perform well. While this information was helpful for the teachers and school administrators, it was too late. The students in the classes in which the teachers did not teach the new standards had already lost a year of math instruction and had large gaps in the prerequisite knowledge needed to perform successfully in the next grade level. The school spent the next two years providing opportunities for remediation for these students, but they are still struggling as they work through high school math courses that build on the content they were not taught in sixth grade. The school was able to respond and correct the problem for the next group of students, but the students in this study continue to struggle as a result of poor decision-making by teachers and school administrators. The teachers who did not teach the

curriculum acted as many others have according to Hargreaves (2001), refusing to put time and energy into learning to teach a new curriculum because the change may not last more than a couple of years anyways. Unfortunately, the students are the ones who had to pay for this decision.

Students in the treatment group were taught a performance-based curriculum that was designed to give students learning experiences that were tied to real-life experiences, thus making them more memorable and applicable. Noddings (2008) believes that without this connection to real-life ideas, learning becomes fragmented and meaningless. McKinney and Frazier (2008) and Weiss and Pasley (2004) also stress the need for hands-on, experiential learning for students to challenge them to higher levels of thinking, resulting in higher levels of understanding. The teachers that refused to teach the new curriculum drilled basic math facts and concepts with students without pushing them to connect their learning to real life or think on a higher level. When the students were given a test that required them to think more deeply and make more connections with their content, they were not able to perform.

This study disputes some of the claims made by researchers studying standardized testing. Nichols and Berliner's 2008 study found that standardized testing is leading to a more narrow curriculum focused on drilling test items, resulting in students feeling a disconnect between school and real life. The focus on performance and hands-on, experiential learning in Georgia's new curriculum may be resulting in just the opposite. The teachers who taught the old curriculum approached teaching with a desire to drill skills for students to memorize with little or no connection to the real world or other

disciplines; however, the new curriculum, when implemented in the manner intended, focuses on making connections and helping students find meaning in the content.

The question of the value of textbooks in classrooms is debated often in recent times, particularly with the growing amount of information available through electronic sources. Reys, Reys, and Chavez (2004) stress the need for textbooks that closely align with the mandated curriculum and that provide professional development for those expected to teach from the book. While this may have helped the resistant teachers to attempt to teach the new curriculum, it probably would not have made enough difference. The new curriculum was designed to force teachers to more closely examine the standards and create materials that were most appropriate for the students they teach. Hands-on activities that connect concepts to real life and other disciplines were essential. Two years after the implementation of the standards, Georgia adopted new math textbooks. The teachers in the school had been teaching the new curriculum for two years at that point and had a clear understanding of what was expected of them. No textbook company was able to produce a book that fully aligned with the state curriculum. The school adopted the book that most closely aligned, but teachers only use it as a resource and not as a guide for instruction. While Putnam (1992) believes it is essential that teachers use a textbook that aligns to the required curriculum, the math teachers in Georgia would disagree. They are successfully teaching the mandated standards without a textbook to guide them.

The damage the students have experienced as a result of not being taught the correct math standards for one year has been long-lasting. Welch, Anderson, and Harris (1982), Ma and Willms (1999), and Jones (1988) all discuss the factors of success in



higher level high school math courses. They all agree that, for students to function in upper level courses, they must receive challenging instruction that pushes them to higher levels of thinking in the years prior to high school. For those students not given the appropriate pre-requisite skills, they are not able to function in classes that are more abstract and require a solid foundation of mathematical understanding (Welch, Anderson, & Harris, 1982; Ma & Willms, 1999; Jones, 1988). The students in this study are now freshmen in high school, and, while they are receiving extra coursework to fill the gaps in their knowledge, time will tell if it is possible to overcome the barrier created by their lack of prerequisite skills in math.

Studies on the role of the teacher in the classroom have shown that student mastery of content is closely related to the quality of the instruction given. Muijs and Reynolds (2000) found in the UK that research-based teaching practices accounted for a positive increase in student achievement, but when a master teacher uses those teaching practices, the gains are significantly higher. To take this a step further, Amrein-Beardsley (2007) believes the only way to improve education is to recruit high-quality teachers and place them with the students that need the most assistance. To produce these high-quality teachers, it is necessary for schools to provide relevant training on research-based strategies that are proven to improve the quality of the education a student receives (Benton & Benton, 2008; Rebore, 2001; Blase, 1998).

### Conclusion

The test scores between the two groups of students were statistically different enough to consider the impact curriculum had on sixth grade students in Georgia during the first year of the new math standards. Even after controlling for differences in ability

level of the students, the disparity between the sets of scores was great. This information cannot be ignored in this age of accountability for educators. What happens in the classroom has an impact on student test performance, resulting in consequences for students (when promotion/retention is tied to test scores), schools (risk of being considered a “needs improvement” school), school systems (could suffer sanctions by the state and a loss of federal funding), and state departments of education (who have to answer to the federal government for AYP under NCLB). With the stakes so high for all involved in education, it is critical that oversight be provided for curriculum implementation to ensure all students receive the information that is necessary for them to be successful in school and beyond.

#### Implications for Practice

Because the difference in the test scores of the two groups of students was significant, it is important for teachers to understand the relationship between standardized tests and curriculum. This study shows a strong relationship between classroom practices in instruction and student performance on the state test.

For those involved in curriculum implementation, more guidance may be needed as teachers work with new standards and content. The treatment group teacher in this study fully understood the new curriculum, as she had attended all of the state trainings and heard first-hand the information that was given. The other two teachers were trained; however, their training was different than what the state-trained teacher received. The teacher who attended the state training spent multiple days in training sessions breaking down each standard and discussing how to best convey that standard to students. The other two teachers received sporadic redelivery trainings lacking in the deep discussion

and careful analysis of each standard. It may have been more helpful for all of the teachers to experience the same training to increase understanding and ownership of the new curriculum. Hargreaves, Earl, Moore, and Manning (2001), found that, as new curriculum was mandated, if the standards did not allow for interpretation by the teacher or ability to integrate other content into the material, teachers often resented and resisted the change. Also, as changes occurred, teachers made value judgments about the change and did not implement the new standards if they perceived that the change was not going to last more than a few years. (Hargreaves, et. al., 2001) For this study, two of the three teachers involved decided that the new curriculum was not worth implementing, believing that the state department had not planned the assessment to match the content. Because of their distrust of the state department of education and its policies, and because they were not involved directly in the training experiences to understand its value, the teachers resisted the change. As the state of Georgia considers future implementation plans, it may be helpful for each teacher to be directly involved in training to ensure equitability and consistency in instructional practices across the state.

At the school level, teachers could benefit from more guidance in implementation. The teachers in this study, because they were experienced, quality professionals, were trusted to make the best decisions about the appropriateness of their methods and content in the classroom. Because they were not all forced to deliver the mandated curriculum, two of them chose to teach the students standards that would not be assessed on the state test and left gaps in the students' knowledge, resulting in difficulty in understanding math at the next grade level. If the school administration had insisted the teachers teach only the state mandated standards, the students would all have had an equal opportunity to

excel in math that year and the years following. Instructional leadership is essential in schools to ensure students are receiving the most appropriate education using the best, most current, research-based strategies (Ylimaki, 2007; Weller, 1999).

Training in research-based teaching strategies would be helpful for all teachers to ensure their students are given the opportunity to learn in the most appropriate way. Gardner's (1983) theory on Multiple Intelligences states that individuals learn in different ways and can be successful if taught in a manner that is tailored more for their strengths and interests. Anderson (2007) believes that involving the learner in making choices and setting personal goals can also help them to better connect their learning to real life, giving it meaning. It is also important to limit rote learning and drilling skills and create learning experiences that are differentiated to reach all students regardless of ability, socio-economic status, intelligence, or ethnicity (George, 2005; Tomlinson, 2005; Woodward & Brown, 2006).

The state textbook adoption cycle did not align with the implementation of the new curriculum, so teachers were left to search for or create their own teaching materials. While this was an exhausting task for the teacher of the treatment group (she had no help from the teachers who refused to teach the standards), she did provide excellent learning experiences for her students by doing so. Without relying on a textbook to drill skills, she was forced to fully examine the standards and find creative ways to teach each skill. By researching teaching activities on the internet and networking with math teachers in other school systems, she gained a wealth of knowledge about the content and teaching methods related to the standards than she would have received by following a math textbook to teach. At the time of implementation, teachers across the state expressed

frustration at the lack of textbooks, but now, most of those teachers only supplement their teaching with a textbook, realizing that performance-based learning experiences are much more meaningful and provide for more lasting understanding for their students.

Accountability at the school level is crucial. Because of the dramatic drop in test scores in the year of this study and the low scores of the cohort group of students in the following years, the school was under much greater scrutiny to provide the appropriate curriculum to their students. All educators must understand their role in the process of growing students, and they should all be held accountable for their actions and decisions. The decision to not provide the appropriate curriculum to the students in the control group is still affecting those students as they struggle to complete courses in high school. They never were able to recover from a year of lost instruction. It is critical that teachers and administrators understand the effect their decisions have on lives. Anyone not willing to provide the best education for his or her students should not be allowed to remain in the profession.

Studies on higher-level math classes found that students who were willing and capable of taking these courses were those who had previously taken higher-level math courses (Welch, Anderson, & Harris, 1982). Jones (1988) also states that students must have quality instruction in math to be able to perform in advanced courses. Prerequisite skills are crucial to understand math at each level of schooling. If a student has gaps in his or her prerequisite knowledge, it is difficult, if not impossible, to learn concepts that build on those skills. For the students in this study, the control group was not given access to a school year of math standards that were necessary for success in the subsequent grade levels. It has been difficult for these students to function in math

classes, and they continue to perform poorly each year on state assessments. As these students progress through high school (they are currently in ninth grade), they will likely struggle each year and will not be prepared to take higher-level courses without remediation to teach them the skills that were missed several years ago.

This study examines assessment and its relationship to the taught curriculum. The purpose of assessment should be to provide information about students' understanding of the curriculum and make decisions regarding instruction to better teach content in a meaningful way. Standardized tests given at the end of the year to assess student understanding of a state-mandated curriculum are typically viewed as summative tests that give little information to assist in instructional decisions. Because this study showed a strong relationship between student performance on the standardized test and the curriculum they received, the sixth grade math test in Georgia should yield usable results for teachers to use to improve their classroom practices.

#### Limitations

There are several factors that can affect the accuracy of the study. Classroom events discussed in the study occurred three years ago, so the details of what happened are not as descriptive as they could have been if the study had been conducted earlier. Triangulation of data (interviews with multiple sources and document examination) was used in an attempt to reduce the impact of time on the information.

Because there are so many factors influencing students and schools, it is difficult to make inferences about the nature of the difference in test scores. The curriculum implementation was very different for the two groups of students, but it is possible that there were other factors influencing each group that may account for all or part of the

difference in scores. The control group (who were taught the new curriculum) contained all of the gifted and high-achieving students for that grade level and many of the students from more affluent families, while the other group contained all of the special education students and was made up mostly of average to low learners. Using a pre-test as a covariate when comparing scores between the two groups should control the impact of this difference.

The 1982 study by Welch, Anderson, and Harris found that home and community factors account for 24% of the variance in student test scores, and previous courses taken in math account for another 34% of the scores. While the study gives hope that the remaining amount of variance, 42%, can be attributed to classroom practices, it is impossible to state definitively (Welch, Anderson, & Harris, 1982). There are so many factors that influence students each day that no statistical analysis could account for all of them. This study accounts only for differences in student ability level as measured by a pre-test and does not account for any other factors that could have an affect on student performance, such as socio-economic status, ethnicity, or parent education.

The danger in drawing conclusions based on the data is that many factors influence students each day. Hursh (2005) believes that with the growing accountability in education, teachers are altering classroom practices to align with standardized testing practices, resulting in a narrowed, somewhat meaningless, curriculum. Schools and school systems are pouring resources into helping students who are on the verge of passing to ensure they improve, while the lower level learners are allowed to struggle (Hursh, 2005). Because of the difference in student ability in the two groups, as measured by the pre-test, it is possible that the effect Hursh discussed happened in the

school. The control group contained most of the lower achieving students who may have not had access to extra opportunities for assistance, while the treatment group contained more average and above average students who could positively affect accountability measures for the school and may have been offered extra tutoring or other assistance to prepare them for the test.

While the curriculum was different for the two groups, the teachers were also different. All three teachers were experienced veteran teachers; however, their teaching styles and methods varied in comparison to each other. The quality of the instruction may have varied between the groups. The results could simply be a factor of the teacher of the treatment group being a better teacher. The treatment group teacher may have also given her students better test-taking strategies, equipping them to answer the questions with more efficiency and finish the test within the allotted time (Ryan, et. al., 2007).

The state-mandated criterion-referenced test is well guarded and not able to be accessed by anyone. There is no way to determine if the test matched the curriculum or even to know if the new test, supposedly aligned to the new standards, was any different from the test on the old standards. The data contained in this study should show whether or not the students performed differently based on the standards they were taught, but without seeing the test, no one can state with certainty anything about the actual test.

The school used for this study is a rural school that is not very diverse in terms of race or ethnicity, and the focus will only be on what occurred in the state of Georgia three years ago. It will not be possible to generalize the results of this study to any other school, system, or state. The purpose of the study is not generalization; it is to give



insight into what occurred in the school as related to the state curriculum and standardized testing to provide information on how to best implement curricular change. If the results showed there was no significant difference in the means of the test scores of the two groups, it would not be appropriate for a school to determine that they can vary greatly from the state standards and still maintain a competency level on the state test. This is only a snapshot of one grade level, in one subject, during one year, on one test.

### Recommendations

At the school level, it is essential that instructional leadership be provided to ensure all students have access to the appropriate content. It is unfair to hold students accountable for standards that they have not been taught. School administrators must view instructional leadership as an integral part of their job and work constantly to be cognizant of classroom practices and areas in need of professional development.

For school administrators to provide appropriate instructional leadership, it is essential that they fully understand how to do this. Training opportunities must be provided beyond the traditional graduate degree program. Administrators need to be given the proper tools, including coaching and mentoring within their first several years on the job to ensure they are prepared to give their faculty the guidance and support necessary to provide a high-quality education for every child.

It is also necessary for school administrators to make difficult decisions regarding personnel who are not performing at the appropriate level. If a teacher refuses or is unable to teach the curriculum, guidance and training are necessary. If the instruction does not improve to an acceptable level, it may be necessary to consider a move to a different teaching position or removal of the teacher from the classroom. Accountability

is crucial at the school level, and if teachers are not willing or are unable to provide students with a top-notch education, they should no longer be allowed to teach.

School district administrators should view their jobs as supporters of teachers and as such, should be very involved when a new curriculum is implemented. They should attend training sessions and be fully versed in the new standards to be able to walk into classrooms and know if the new curriculum is being implemented correctly. If the state department of education is not providing the appropriate training or materials, they could also act a liaison, working with state officials to alter training practices and/or create better materials. Funding for instructional materials from the district level would also help teachers implementing new standards with no state approved textbooks, particularly when moving to a performance-based curriculum in which students are expected to learn each concept through hands-on activities.

Professional development should be examined from the school district level to ensure all school and system administrators are equipped with the necessary skills to provide classroom coaching and follow-up for teachers learning new skills and concepts. It has been acceptable in education to send a teacher to a training session and expect that he or she was given all of the necessary information and materials to fully implement a new idea. In reality, it is rare that any individual returns from a training session ready to fully implement. Instructional leaders within the school should be empowered to provide coaching opportunities for the faculty, particularly when learning new content and/or teaching methods.

University programs preparing educational leaders must not abandon crucial areas of administration but should ensure the main focus of leadership preparation programs is

on instructional leadership. This requires employing a faculty of practitioners familiar with current educational research and best practices that can teach future leaders the skills necessary to provide coaching and guide instructional change in schools. Partnerships should exist between schools of educational leadership and school systems to provide opportunities for supervised internships, allowing learning in an arena that allows for trial and error. The way many programs are designed, students rarely are given the opportunity to act in a meaningful leadership capacity until they secure leadership certification and an official leadership position. Once entering administration, time constraints typically do not allow for extensive training on quality leadership.

At the state level, more direction and oversight is needed when implementing change. It should not be acceptable to state that a change will happen without giving guidance and a clear vision to those expected to conduct that change. If there is a vision for a new curriculum, it may be necessary to examine and possibly alter the textbook and instructional material adoption cycle to ensure teachers have a wealth of information to assist them in the classroom. It would also be helpful to provide expert trainers and make that training available to all who will participate in the new program. Web-based training could be used to ensure everyone has access to the same information, including a goal or vision for the new program, strategies to implement, and a chance to ask clarifying questions of the trainer. Not only would this allow schools to hold each teacher more accountable (since they all received the same training), it would alleviate the pressure from peers charged with training peers.

#### Recommendations for Future Research

This study adds to the growing body of literature on the relationship between

curriculum and assessment. Because it only studies one school in one state, it would be helpful for future studies to examine practices in other states to determine best practices for high-stakes testing alignment. If the body of research in this area grows, it could be influential in affecting policy at the local, state, and federal levels. Assessment is mandated by the federal government through No Child Left Behind (NCLB), and each state has created their own plan for providing this information. Locally, districts are implementing curriculum with the hope that it will yield results high enough to avoid sanctions by the state and federal governments. With the high stakes attached to assessment in education today, it is crucial to have information to guide policy and practice to ensure success for schools.

The same types of studies would be helpful in examining practices in classroom assessment to determine if teachers' practices reflect the state-mandated curriculum. One such study in Maryland found that the state standardized test reflected the curriculum, but assessments used throughout the school year in classrooms typically did not (Parke & Lane, 2008). The Center on Educational Policy (2008), in a study of successful schools, found that the schools cited aligning their curriculum to the year-end, high-stakes test as the reason for their success. If the state would ensure that their curriculum was aligned to the test, it would not be necessary for schools to alter the taught curriculum to reflect testing practices. By aligning instructional practices and classroom assessments with state-mandated standards, teachers would be able to place less emphasis on drilling standardized test questions throughout the year to prepare for the end of year assessment.

#### Summary

With the growing focus on accountability for schools, school systems, and state

departments of education, it is necessary to examine the role of assessment in education and to ensure that the most appropriate measures are used to judge student learning. Alignment of assessment and curriculum is necessary to provide useful and valid data for decision-making. In this study, the criterion-referenced competency test given to sixth grade math students at the end of the school year does appear to match the state-mandated, performance-based curriculum. Because the test and standards are aligned, it is possible to make instructional decisions and adjustments, the ultimate purpose of any assessment program, based on student test results. In the future, it would be helpful to have more research on other grade levels and subject areas in Georgia as well as other states to provide a set of best practices in state-mandated assessments.

## REFERENCES

- 2005 GA CRCT Technical Report. (2005). Georgia Department of Education.
- 2006 GA CRCT Technical Report. (2006). Georgia Department of Education.
- Allsopp, D.H., Kyger, M.M., Lovin, L., Gerretson, H., Carson, K.L., & Ray, S. (2008).  
 Mathematics dynamic assessment. *Teaching Exceptional Children, Jan/Feb.*, 6-16.
- American Psychological Association. (2001). Appropriate use of high-stakes testing in our nation's schools. Retrieved on November 1, 2008, from <http://www.apaonline.com>
- Amrein-Beardsley, A. (2007). Recruiting expert teachers into hard-to-staff schools. *Phi Delta Kappan, 89*, 64-67.
- Anderson, K.M. (2007). Differentiating instruction to include all students. *Preventing School Failure, 51*(3), 49-54.
- Bascia, N. & Hargreaves, A. (2000). *The Sharp Edge of Educational Change: Teaching, Leading and the Realities of Reform*. New York, NY: RoutledgeFalmer.
- Bays, D.A. & Crockett, J.B. (2007). Investigating instructional leadership for special education. *Exceptionality, 15*(3), 143-161.
- Benton, B. & Benton, D. (2008). Professional development with a focus. *The Delta Kappa Gamma Bulletin, 74*(4), 24-28.
- Blase, J. & Blase, J. (1998). *Handbook of Instructional Leadership*. Thousand Oaks, CA: Corwin Press, Inc.

- Brown, A.S. (2008). President's panel urges more for math. *Mechanical Engineering*, 130(5), 9-10.
- Burch, P. (2007). The professionalization of instructional leadership in the United States: competing values and current tensions. *Journal of Educational Policy*, 22(2), 195-214.
- Campbell, D.T. (1976). Assessing the impact of planned social change. Paper #8 Occasional Paper Series. The Public Affairs Center, Dartmouth College.
- Center on Education Policy. (2008). Some perspectives from rural school districts on The No Child Left Behind Act. Retrieved on October 14, 2008, from <http://www.cep-dc.org/index.cfm?fuseaction=Page.viewPage&pageId=495&parentID=481>
- Civil Rights.org. (n.d.) Civil Rights 101: School Desegregation and Equal Educational Opportunity. Retrieved July 14, 2008, from [http://www.civilrights.org/research\\_center/civilrights101/desegregation.html](http://www.civilrights.org/research_center/civilrights101/desegregation.html)
- Committee on Science and Technology, U.S. House of Representatives. (2007). President signs Gordon's COMPETES Act. Retrieved on October 14, 2008, from <http://science.house.gov/press/PRArticle.aspx?NewsID=1945>
- Costa, A.L. (2008). The thought-filled curriculum. *Educational Leadership*, 65(5), 20-24.
- Cozzens, L. (1998). Brown v. Board of Education. *African American History*. Retrieved October 13, 2008, from <http://www.watson.org/~lisa/blackhistory/citing.html>
- Criterion-Referenced Competency Tests (CRCT). (n.d.). Retrieved October 1, 2007

from [http://www.gadoe.org/ci\\_testing.aspx?PageReq=CI\\_TESTING\\_CRCT](http://www.gadoe.org/ci_testing.aspx?PageReq=CI_TESTING_CRCT)

Cuban, L. (1992). Better teaching or 'just the facts, ma'am'?. *Education Digest*, 92(58), 40-42.

Darling-Hammond, L. (1997). *Doing What Matters Most: Investing in Quality Teaching*. New York: Teachers' College, Columbia University.

Douglas, O., Burton, K.S., Reese-Durham, N. (2008). The effects of the multiple intelligence teaching strategy on the academic achievement of eighth grade math students. *Journal of Instructional Psychology*, 35(2), 182-187.

Ezarik, M. (2005). Lessons to learn: U.S. vs. Singapore math. *District Administration*, 41(5), 70.

Ezarik, M. (2005). Math system change: Two states, two approaches. *District Administration*, 41(7), 57.

FindLaw. (n.d.) U.S. Constitution: Tenth Amendment. Retrieved October 13, 2008, from <http://caselaw.lp.findlaw.com/data/constitution/amendment10/>

Foley, B.P. & Buckendahl, C.W. (2007). Evaluating the alignment of the Full 2007 Dakota STEP Mathematics Assessment Forms with South Dakota's Academic and Achievement Standards. Report prepared for the South Dakota Department of Education by the Buros Center for Testing at University of Nebraska- Lincoln.

Fullan, M. (1990). *Changing School Culture through Staff Development: Yearbook of the Association for Supervision & Curriculum Development*. Virginia: Association for Supervision and Curriculum Development.

Gardner, H. (1983). *Frames of Mind*. New York: Basic Books.

George, P.S. (2005). A rationale for differentiating instruction in the regular classroom.



*Theory Into Practice*, 44(3), 185-193.

Georgia Department of Education. (2003). Georgia Learning Connections: Quality Core Curriculum for Sixth Grade Mathematics. Retrieved September 1, 2008, from <http://www.georgiastandards.org/DMGetDocument.aspx/6-8math.pdf?p=6CC6799F8C1371F65423344ADA034785FADDA3708FD68A517F574523EE020954&Type=D>

Georgia Department of Education. (2005). 6-8 Mathematics Georgia Performance Standards. Retrieved on September 1, 2008, from <http://public.doe.k12.ga.us/DMGetDocument.aspx/Standards%20MS%206-8%20July%202006.pdf?p=6CC6799F8C1371F6B5613E7BAA5B059530027905216E22552727CC5B9D8C6BA9&Type=D>

Georgia Department of Education. (n.d.). Curriculum frequently asked questions.

Retrieved on November 8, 2008, from <http://www.georgiastandards.org/faqs.aspx#q2>  
 Gimbert, B., Bol, L., & Wallace, D. (2007). The influence of teacher preparation on student achievement and the application of national standards by teachers of mathematics in urban secondary schools. *Education and Urban Society*, 40(1), 91-117.

Glatthorn, A.A. (1994). *Developing a Quality Curriculum*. Alexandria, VA: Association for Supervision and Curriculum Development.

Glickman, C.D., Gordon, S.P., & Ross-Gordon, J.M. (2001). *Supervision and Instructional Leadership: A Developmental Approach*. Boston, MA: Allyn and Bacon.

Gordon, B. (2007). U.S. competitiveness: The education imperative; because the

foundation for success is a well-educated workforce, the necessary first step in any competitiveness agenda is to improve science and mathematics education.

*Issues in Science and Technology*, 23(3), 31-37.

Guskey, T.R. (2000). *Evaluating Professional Development*. Thousand Oaks, CA: Corwin Press, Inc.

Halawah, I. (2005). The relationship between effective communication of high school principals and school climate. *Education*, 126(2), 334-345.

Hargreaves, A., Earl, L., Moore, S., & Manning, S. (2001). *Learning to Change*. San Francisco, CA: Jossey-Bass.

Hopkins, D. & Higham, R. (2007). System leadership: Mapping the landscape. *School Leadership and Management*, 27(2), 147-166.

Howell, D.C. (2008). *Fundamental Statistics for the Behavioral Sciences*. Belmont, CA: Thomson-Wadsworth.

Hursh, D. (2005). The growth of high-stakes testing in the USA: Accountability, markets and the decline in educational equality. *British Educational Research Journal*, 31(5), 605-622.

Hyde, A. (2007). Mathematics and Cognition. *Educational Leadership*, 65(3), 43-47.

Imbornoni, A. (2007). Women's rights movement in the U.S. Retrieved on July 14, 2008, from <http://www.infoplease.com/spot/womenstimeline1.html>

Jamshed, B. (2008). America can teach Asia a lot about science, technology, and math. *Chronicle of Higher Education*, 54(20), 33-34.

Jones, L.V. (1988). School achievement trends in mathematics and science, and what can be done to improve them. *Review of Research in Education*, 15, 307-

341.

- Joyce, B. & Showers, B. (1983). *Power in Staff Development through Research on Training*. Washington, D.C.: Association for Supervision and Curriculum Development.
- Khattri, N., Kane, M.B., & Reeve, A.L. (1995). How performance assessments affect teaching and learning. *Educational Leadership*, 53(3), 80-83.
- Killion, J. & Kaylor, B. (1991). Follow-up: The key for training for transfer. *Journal of Staff Development*, 12(1), 64-67.
- Kimball, S.M., White, B. & Milanowski, A.T. (2004). Examining the relationship between teacher evaluation and student assessment results in Washoe County. *Peabody Journal of Education*, 79(4), 54-78.
- Klein, D. (2003). A Brief History of American K-12 Mathematics Education in the 20<sup>th</sup> Century. *Mathematical Cognition*. Retrieved October 1, 2007, from <http://www.csun.edu/~vcnth00m/AHistory.html>
- Knowles, M.S. (1984). *Andragogy in Action: Applying Modern Principles of Adult Learning*. San Francisco, CA: Jossey-Bass.
- Kratochwill, T.R., Volpiansky, P., Clements, M., & Ball, C. (2007). Professional development in implementing and sustaining multitier prevention models: Implications for response to intervention. *School Psychology Review*, 36(4), 618-631.
- Kyriakides, L., Charalambous, C., Philippou, G., & Campbell, R.J. (2006). Illuminating reform evaluation studies through incorporating teacher effectiveness research: A case study in mathematics. *School Effectiveness and School Improvement*, 17(1),

3-32.

Little, J. (1993). Teachers professional development in a climate of educational reform.

*Educational Evaluation and Policy Analysis*, 15(2), 129-151.

Ma, X., Willms, J.D. (1999). Dropping out of advanced mathematics: How much do

students and schools contribute to the problem? *Educational Evaluation and*

*Policy Analysis*, 21(4), 365-383.

Mansilla, V.B. & Gardner, H. (2008). Disciplining the mind. *Educational Leadership*,

65(5), 14-19.

McKinney, S. & Frazier, W. (2008). Embracing the principles and standards for school

mathematics: An inquiry into the pedagogical and instructional practices of

mathematics teachers in high-poverty middle schools. *The Clearing House*,

81(5), 201-210.

Mohammed, R.F. (2006). What hinders change in classroom practice? Lessons from the

field and future directions in Pakistan. *Journal of In-Service Education*, 32(3),

375-385.

Muijs, D. & Reynolds, D. (2000). School effectiveness and teacher effectiveness in

mathematics: Some preliminary findings from the Evaluation of the Mathematics

Enhancement Programme (Primary). *School Effectiveness and School*

*Improvement*, 11(3), 273-303.

National Academy of Sciences, National Academy of Engineering, & Institute of

Medicine. (2005). Rising above the gathering storm: Energizing and employing

America for a brighter economic future. Retrieved on October 14, 2008, from [http://sciencedems.house.gov/Media/File/Reports/natacad\\_compete\\_exsum\\_6feb06.pdf](http://sciencedems.house.gov/Media/File/Reports/natacad_compete_exsum_6feb06.pdf)

National Center for School Engagement. (n.d.). Compulsory Attendance Laws.

Retrieved on January 18, 2009, from <http://www.truancy prevention.org/TruancyPreventionRegistry/Admin/Resources/Resources/15.pdf>

National Institute for Direct Instruction. (n.d.). What is direct instruction (DI)?

Retrieved on October 14, 2008, from <http://www.nifdi.org/>

Ng, J.C. (2006). Understanding the impact of accountability on preservice teachers' decisions about where to teach. *The Urban Review*, 38(5), 353-372.

Nichols, S.L. & Berliner, D.C. (2005). The inevitable corruption of indicators and educators through high-stakes testing. East Lansing, MI: The Great Lakes Center for Education Research & Practice.

Nichols, S.L. & Berliner, D.C. (2008). Testing the joy out of learning. *Educational Leadership*, 65(6), 14-18.

Noddings, N. (2008). All our students thinking. *Educational Leadership*, 65(5), 8-13.

Osta, I. (2007). Developing and piloting a framework for studying the alignment of mathematics examinations with the curriculum: The case of Lebanon. *Educational Research and Evaluation*, 13(2), 171-198.

Parke, C.S. & Lane, S. (2008). Examining alignment between state performance assessment and mathematics classroom activities. *The Journal of Educational Research*, 101(3), 132-146.

- Penner, A.M. & Paret, M. (2008). Gender differences in mathematics achievement: Exploring the early grades and the extremes. *Social Science Research, 37*(1), 239-253.
- Popham, W.J. (2001). *The Truth About Testing: An Educator's Call to Action*. Alexandria, VA: Association for Supervision and Curriculum Development.
- Printy, S.M. & Marks, H.M. (2006). Shared leadership for teacher and student learning. *Theory Into Practice, 45*(2), 125-132.
- Rebore, R.W. (2001). *Human Resources Administration in Education: A Management Approach*. Boston, MA: Allyn and Bacon.
- Reys, B.J., Reys, R.E., & Chavez, O. (2004). Why mathematics textbooks matter. *Educational Leadership, 61*(5), 61-66.
- Rock, M.L., Gregg, M., Ellis, E., & Gable, R.A. (2008). REACH: A framework for differentiating classroom instruction. *Preventing School Failure, 52*(2), 31-47.
- Ryan, K.E., Ryan, A.M., Arbuthnot, K., & Samuels, M. (2007). Students' motivation for standardized math exams. *Educational Researcher, 36*(1), 5-13.
- Sass, E. (2008). American educational history: A hypertext timeline. Retrieved October 13, 2008, from <http://www.cloudnet.com/~edrbsass/educationhistorytimeline.html>
- Schiller, K.S. & Muller, C. (2000). External examinations and accountability, educational expectations, and high school graduation. *American Journal of Education, 108*, 73-102.
- Schugurensky, D. (2002). 1965 Elementary and Secondary School Act, the 'War on Poverty' and Title I. Retrieved on October 13, 2008, from

[http://www.wier.ca/~daniel\\_schugurens/assignment1/1965elemsec.html](http://www.wier.ca/~daniel_schugurens/assignment1/1965elemsec.html)

Scott, D., ed. (2001). *Curriculum and Assessment*. Westport, CT: Ablex Publishing.

Sebring, P.B., Allensworth, E., Bryk, A.S., Easton, J.Q., & Luppescu, S. (2006).

Research report: The essential supports for school improvement. Chicago, IL:

Consortium on Chicago School Research at the University of Chicago.

Seyfarth, J.T. (1996). *Personnel Management for Effective Schools*. Boston, MA:

Allyn and Bacon.

Standard. (2008). In *Merriam-Webster Online Dictionary*. Retrieved September 14,

2008, from <http://www.merriam-webster.com/dictionary/standard>

Steen, L.A. (2007). Making mathematics count. *Educational Leadership*, 65(3), 8-14.

Stiggins, R. & Duke, D. (2008). Effective instructional leadership requires assessment

leadership. *Phi Delta Kappan*, 90(4), 285-291.

Thompson, G. (2008). Beneath the apathy. *Educational Leadership*, 65(6), 50-54.

Tomlinson, C. (2005). This issue: differentiated instruction. *Theory Into Practice*,

44(3), 183-184.

Tyler, R.W. (1949). *Basic Principles of Curriculum and Instruction*. Chicago, IL: The

University of Chicago Press.

United States Department of Education. (2004). A guide to education and No Child Left

Behind. Retrieved on October 13, 2008, from

<http://www.ed.gov/nclb/overview/intro/guide/guide.pdf>

United States Department of Education. (2007). A 25 year history of the IDEA.

Retrieved on October 13, 2008, from

<http://www.ed.gov/policy/speced/leg/idea/history.html>

- United States Department of Education. (2008). The federal role in education. Retrieved on October 13, 2008, from <http://www.ed.gov/about/overview/fed/role.html>
- Walker, E.N. (2007). Why aren't more minorities taking advanced math? *Educational Leadership*, 65(3), 48-53.
- Weiss, I.R. & Pasley, J.D. (2004). What is high-quality instruction? *Educational Leadership*, 61(5), 24-28.
- Welch, W.W., Anderson, R.E., & Harris, L.J. (1982). The effects of schooling on mathematics achievement. *American Educational Research Journal*, 19(1), 145-153.
- Weller, L.D. (1999). *Quality Middle School Leadership*. Lancaster, PA: Technomic Publishing Co., Inc.
- Weller, L.D. & Weller, S. (2000). *Quality Human Resources Leadership*. Lanham: The Scarecrow Press, Inc.
- Winter, E.C. & McEachern, W.R. (2001). Dealing with educational change: The Ontario experience. *Education*, 121(4), 682-688.
- Woodward, J. & Brown, C. (2006). Meeting the curricular needs of academically low-achieving students in middle grade mathematics. *The Journal of Special Education*, 40(3), 151-159.
- Ylimaki, R. M. (2007). Instructional leadership in challenging US schools. *International Studies in Educational Administration (Commonwealth Council for Educational Administration & Management (CCEAM))*, 35(3), 11-19.