DIGITALCOMMONS
@WAYNESTATE

Wayne State University

Wayne State University Dissertations

1-1-2010

The Relationship Between Core-Plus Mathematics Project And Student Achievement

Karen Renee Treadway-Harvel
Wayne State University

Follow this and additional works at: http://digitalcommons.wayne.edu/oa_dissertations

Part of the Science and Mathematics Education Commons, and the Secondary Education and Teaching Commons

Recommended Citation
Treadway-Harvel, Karen Renee, "The Relationship Between Core-Plus Mathematics Project And Student Achievement" (2010). *Wayne State University Dissertations.* Paper 150.

This Open Access Dissertation is brought to you for free and open access by DigitalCommons@WayneState. It has been accepted for inclusion in Wayne State University Dissertations by an authorized administrator of DigitalCommons@WayneState.

المنارة للاستشارات

www.manaraa.com

THE RELATIONSHIP BETWEEN CORE-PLUS MATHEMATICS PROJECT AND STUDENT ACHIEVEMENT

by

KAREN R. T. HARVEL

DISSERTATION

Submitted to the Graduate School

of Wayne State University,

Detroit, Michigan

in partial fulfillment of the requirements

for the degree of

DOCTOR OF PHILOSOPHY

2010

MAJOR: CURRICULUM AND INSTRUCTION
(Mathematics Education)

Approved by:

_____
Advisor Date

_____

_____

_____

المنارة للاستشارات

www.manaraa.com

COPYRIGHT BY

Karen R. T. Harvel

2010

All Rights Reserved

المنارة للاستشارات

www.manaraa.com

DEDICATION

This manuscript is dedicated to my wonderful husband, Jonathan Andrew Harvel for the support that led to my success. This body of work is the result of many years, months, and days of working outside the home, and most importantly working inside the home. You have always supported me, but what stood out for me was your undying support when I resigned from my first career to go back to college and pursue another career. In addition, you gave me great support when I decided to pursue my doctorate degree and four years later, I want to say "I love you" and "thank you".

This body of work is also dedicated to my children, Nicole and Matthew Harvel. You are the love of my life and having you in my life completes me. Both of you have worked with your father to give me the time to work on this manuscript. Your love and support during this time period were wonderful. I just want to say that you are my favorite children and I love you.

Mom, you always had confidence in me. When I was completing my bachelor's degree, you always told me that I was going to be a doctor. You had more belief in me than I had in myself. I remember that you tutored me in mathematics, even though it was not your favorite subject. At that time, I thought I was being punished, but years later, I can say that I would not be where I am without your unwavering support.

Lastly, I want to thank the Lord Jesus Christ for he is the head of my life. There were many challenges during the writing of this manuscript that I could not have overcome without your assistance with those challenges. There were times when I did not believe that I could complete the manuscript, but when I prayed and gave those challenges over to you, you opened up doors that I could not have done alone. I will always keep these words in my heart, "Have not I commanded thee? Be strong and of a good courage: be not afraid neither be thou dismayed for the LORD they God is with thee whithersoever thou goest." Joshua 1:9

المنارة للاستشارات
www.manaraa.com

ACKNOWLEDGEMENTS

I wish to acknowledge those who have played a major role in my professional and educational journey. Their roles have been varied and many. Nonetheless, these individual have been crucial to my development.

I wish to acknowledge my family and friends for the words of encouragement and prayer. I especially like to thank my cousin, Rhonda Smith, for taking the time out of her busy schedule to read my work and give helpful advice grammatically and contextually.

My educational colleagues from Renaissance High School made my doctoral journey much easier. They gave me continuous encouragement. I would especially like to thank Cecilia Wallace for assisting me with my dissertation.

My friend, Bob Thomas, began the PhD program over four and half years ago and stopped by to visit me. He told me that I should consider getting my doctorate degree. I could not see the point seeing as it was not a substantial pay increase for me. I stated that he saw great possibilities for me and he thought that I could be a benefit to the education field. Of course I gave it no thought to the idea until he called me to show me around to the campus where he was getting his degree. He even introduced me to key people that could assist me with the process. I just wanted to say that you for planting the seed for higher education.

I want to acknowledge my doctoral committee. I went to see Dr. Thomas Edwards, to let him know that I wanted to pursue my specialist degree. He asked me “why would I want to do that?” He said “why don’t you go for your PhD.” I told him that I had not given it any thought and it sounded like a lot of work. Dr. Edwards, my doctoral advisor, told me that he would help me every step of the way. He stated “just remember, that the difference from people getting a doctorate and people that don’t is the people that get a doctorate have perseverance.” So here I am with the completion of my work and I want to say thank you, Dr. Edwards. Dr. Fahoome

المنارة للاستشارات
www.manaraa.com

showed me that my work must be thorough and consistent. When I thought I completed certain portions of the manuscript, she would highlight that I should include more research to make the topics stronger. Dr. Fahoome's guidance in my research questions and methodology was imperative to the research that was conducted. I want to say thank you for your patience and expertise. Dr. Lawrence Brenton had the most impact for me when I took group theory and ring theory. In the beginning, I was hesitant about taking the courses. Just saying group theory and ring theory brought about fear, but Dr. Brenton's detailed explanation of the topics made it more enjoyable. In addition, he made the courses fun and a great learning experience. When I was deciding on who I wanted on my committee, Dr. Brenton came to my mind. He was always available for guidance and motivation, even during the vacation months. Dr. Ozgun-Koca encouraged me to improve on my dissertation quality. Her presence and participation at my proposal defense was greatly appreciated.

المنارة للاستشارات
www.manaraa.com

TABLE OF CONTENTS

Dedication ii

Acknowledgements iii

List of Tables ix

CHAPTER 1-INTRODUCTION 1

Background 1

Problem Statement 4

Research Objectives and Questions 7

Research Questions 7

Significance of the Study 8

Overview of the Study 8

Definition of Terms 9

CHAPTER 2-A REVIEW OF LITERATURE 11

Introduction 11

Evolution of Testing 11

The History of Educational Testing 13

Evaluation of the Curriculum 15

The development of curriculum evaluation 15

Change in National Standards 16

The History of the "New Math" 18

Change in State Standards 21

The Change to High Stakes Testing 22

The Development of GLSE and HSCE 25

The Performance of GLCE and HSCE 28

المنارة للاستشارات
www.manaraa.com

The Conception of the Curriculum 31

The Practice of Constructivism.....36

Discussions on Core-Plus Mathematics Project 38

Publishers' Drive to Market Traditional Textbooks 40

Discussions of Similar Studies on the Impact of Standardized-Based Teaching on Student Achievement 41

Discussions of Similar Studies on the Impact of Standardized-Based Teaching on Disadvantaged Students 44

Discussion of Social Factors and Attitudes that Hinder Educators from Teaching Reform Methods to Disadvantaged Students.....45

Discussions on Student Achievement 46

Chapter Summary 47

CHAPTER 3-METHODOLOGY 49

Introduction.....49

Research Design.....50

Variables 51

Independent variables 51

Dependent variables.....51

Population and Sampling 52

Data Gathering Methods 53

Instruments.....54

Pretest 54

Examinations.....54

Demographic Survey 56

المنارة للاستشارات
www.manaraa.com

Student Survey 56
Instrument Validity 56
Data Analysis 59
Scales of measurement 59
Input data format 60
Appropriate Statistical Tests 60
Underlying assumptions addressed 60
Nominal alpha selected and rationale 61
Description of computation method 61
Quantitative and Qualitative Summary 61
CHAPTER 4-RESULTS OF DATA ANALYSIS 63
Description of the Sample 63
Pretest Comparisons 65
Research Questions 66
Ancillary Findings 78
Summary 80
CHAPTER 5-DISCUSSION AND CONCLUSION 81
The Effectiveness of CPMP 84
Students' Attitudes toward CPMP 85
Gender's Role on Procedural and Conceptual Knowledge 86
Conclusions 86
Limitations of the Study and Recommendations for Future Practices 87
Limitations of the Study and Recommendations for Future Research 88
Final Note 90

المنارة للاستشارات
www.manaraa.com

Appendix A-Demographic Survey 92

Appendix B-Perceptions of CPMP Mathematics Instruction 93

Appendix C-Pretest 95

Appendix D-Examination One: Writing Linear Equations 116

Appendix E – Rubric for Examination One 118

Appendix F – Examination Two: Graphing Linear Equations and Inequalities 120

Appendix G – Rubric for Examination Two 123

Appendix H – Examination Three: Systems of Linear Equations and Inequalities 125

Appendix I – Rubric for Examination Three 127

Appendix J – Final Examination (Examination One, Examination Two, and Examination Three) 129

Appendix K – Rubric for Final Examination 131

Appendix L – Parental Consent, Adolescent Assent Form, and HIC's Approval 134

Appendix M – Detroit School District Approval and Parent Meeting Letter 137

References 143

Abstract 156

Autobiographical Statement 158

المنارة للاستشارات

www.manaraa.com

LIST OF TABLES

Table 1 Procedural and Conceptual Examinations 52

Table 2 Crosstabulation-Gender of Students 64

Table 3 Crosstabulation-Race/Ethnicity of Students 64

Table 4 t-Test for Two Independent Samples-Pretest Scores by Group Membership.....65

Table 5 t-test for Two Independent Samples-Pretest Scores by Gender.....66

Table 6 One-way Multivariate Analysis of Covariance-Procedural Knowledge by Group Membership 67

Table 7 Descriptive Statistics-Adjusted Procedural Scores by Group Membership 67

Table 8 One-way Multivariate Analysis of Covariance-Conceptual Knowledge by Group Membership 68

Table 9 Between-Subjects Effects-Contextual Knowledge by Group Membership.....69

Table 10 Descriptive Statistics-Adjusted Contextual Scores by Group Membership 70

Table 11 t-test for One Sample-Perceptions of CPMP Mathematics Instruction (Treatment Group Only 71

Table 12 2 x 2 Factorial Multivariate Analysis of Covariance-Procedural Knowledge by Group Membership and Gender.....74

Table 13 Descriptive Statistics-Procedural Examination Scores by Group and Gender 75

Table 14 2 x 2 Factorial Multivariate Analysis of Covariance-Conceptual Knowledge by Group Membership and Gender.....76

Table 15 Descriptive Statistics-Conceptual Examination Scores by Group and Gender 77

المنارة للاستشارات
www.manaraa.com

CHAPTER 1

INTRODUCTION

Background

Over the past 20 years, there has been public controversy on the education system in the United States due to students' performance in achievement tests in mathematics and science. The Third International Mathematics and Science Study (TIMSS) administered an achievement test for mathematics and science (TIMSS-R, 1999) in 38 countries. The group compared three different grade levels of U.S. students' mathematics and science scores to students in the other 37 countries. It was found that at the middle school level U.S. students are above average in test scores. The test scores revealed that at the high school level the students are average and below average in mathematics and science (TIMSS-R, 1999). Studies show that the below average high school level test scores are the result of students' learning differences based on socioeconomic status (students at risk, disadvantaged, or educationally deprived that come from economically disadvantaged families and from linguistic or ethnic minority backgrounds (Means & Knapp, 1991)). Studies show that part of the problem lie in the effects on students' learning of differences in socioeconomic status (SES), gender, class, and ethnicity (Hoy, Tarter, & Hoy, 2006; Kohr, Coldiron, Skiffinton, Masters, & Blust, 1988). Studies also showed that part of the problem is the effectiveness and preparation of teachers (Ladson-Billings, 1994) and their use of traditional teaching methods instead of standards based instruction (Malloy, 2003; Schoenfeld, 2000).

A review of the research literature shows that sufficient studies are being done on academic achievement of minorities and SES students (Ladson-Billings, 1994; Lubienski, 2000; Stinson, 2006). Paying attention to social class and socioeconomic status is important because it relates to achievement more specific to the learning of mathematics (Campbell,

المنارة للاستشارات
www.manaraa.com

2000). Lubienski pointed out that there should be more studies on SES as an influencing factor. Some mathematics education researchers have found that lower SES students receive rote instruction and low-level exercises whereas higher SES students receive more application type problems (Campbell, 1990; Kohr, Coldiron, Masters, & Blust, 1988; Lubinski, 2000). In contrast, Ladson-Billings (1994) and Reeves (2003) pointed out that while ethnicity/race, SES, and gender are important, these factors alone do not drive academic achievement. According to these authors, the effectiveness of teachers and leadership promotes academic success. Teachers must be culturally relevant in their teaching where they believe that all students, regardless of their background, can and will succeed. This study showed that regardless of students' demographics, teachers' methods, effectiveness and preparation can prepare students for high academic achievement. Ladson-Billings (1994) stated that even though there are moderate gains in student achievement, the school districts have not given enough of an effort in providing quality education to minorities, especially African Americans, in public schools. Many minority students have been taught by ineffective teachers. Moreover, because the teachers often have the perception urban students do not have the ability to learn, they often believe they are incapable of achieving beyond basic procedural knowledge (Ladson-Billings, 1994). There is a need to change the way teachers perceive students. Culturally relevant teaching that ensures students have the capability of achieving excellence is necessary for all students to attain high levels of achievement (Ladson-Billings, 1994). Culturally relevant teachers observe themselves as artists rather than technicians. They also see themselves as part of the community, and they make connections with the world around the students. Culturally relevant teachers are connected to their students and encourage the same connectedness among students.

Ladson-Billings (1994) pointed out that knowledge is continuous, transformable and should be shared with other teachers and students. Most importantly, culturally relevant

المنارة للاستشارات
www.manaraa.com

teachers are passionate and critical of the content of the curriculum. Teachers believe that knowledge is a bridge where learning is about expressing and explaining students' ideas to make connections. Teachers should receive continuous professional development on how to implement the curriculum and how to make it rich and relevant to their students. However, she stated that teachers should be involved in curriculum development and knowledge building, rather than given a mandated, pre-packaged curriculum with additional resources attached. Malloy (2003) agreed that many students are taught by ineffective teachers, but believed this is largely due to the teaching methods they use in the classroom. The role of the mathematics teacher over the last three decades has evolved from giving knowledge to students to facilitating students' active participation in their learning. It is a fallacy for teachers to believe that all students learn the same way (Malloy, 2003). There are multiple ways of learning mathematics. Gardner (1999) pointed out that intelligence is not a single entity where human beings' minds have a blank slate that could be filled with knowledge. He stated that there are multiple intelligences, independent of each other, where children are able to gain knowledge in different ways. Malloy (2003) pointed out that teachers and students need to move toward logical reasoning and conjecturing, as well as exploration and investigation of applications that apply to real world events. Malloy (2003) stated that learners should understand mathematical ideas and have a positive outlook about their learning of mathematics. She pointed out that a positive outlook about learning mathematics is attributable to a standards based curriculum. According to Malloy (2003), the standards based curriculum includes five factors for student learning: Content, tasks, pedagogy, mathematical interaction, and assessment. The content should be rigorous, rich and relevant to students. The tasks should include higher-level thinking skills. Pedagogy is based on methods of instruction, which are the sequencing and complexity of the mathematical topics. Mathematical interaction is how the students justify their answers and interpret and solve problems.

المنارة للاستشارات
www.manaraa.com

Assessment involves teachers having evidence of students' performance, providing feedback to students and the critiquing of their learning (Malloy, 2003). It is important that teachers become culturally relevant as it pertains to the mathematics curriculum. Culturally relevant teachers use standards based instruction to facilitate student learning, provide mathematical tasks to promote conceptual knowledge as well as procedural knowledge, and provide rich instruction to promote the big ideas of mathematics (Ladson-Billings, 1994; Malloy, 2003).

Problem Statement

High school teachers in a large city in the Midwest are presently using the newly-adopted High School Content of Expectations (HSCE, 2006), which are standards based objectives that are used as a guide for instruction. The HSCE was derived from the Grade Level Content Expectation (GLCE) as an extension for the high school curriculum, grades 9-12. The GLCE documents are the third tier of the Michigan Curriculum Framework that is directly correlated to the items on the grade level Michigan Educational Assessment Program (MEAP) assessment (Michigan Department of Education, 2009). The Michigan Curriculum Framework provided a three tiered program for a broader curriculum of what is to be expected to be taught and learned in Michigan schools. GLCE is more specific and clarifies what it is the students are expected to know and do on grade level assessments (Michigan Department of Education, 2009). HSCE provides educators and administers with a detailed set of expectations at each grade level 9-12 with the purpose of being aligned with assessments (Michigan Department of Education, 2009). The newly-adopted textbooks in the District were purchased with the HSCE in mind. In actuality, the textbooks were written for a more traditional curriculum. Van De Walle (2006) pointed out the publishers of textbooks produce textbooks that cover a wide variety of state and professional agendas. The author noted that textbook companies make decisions based on the market, which is comprised of teachers. Teachers are driven by assessments and very little information includes the NCTM standards.

المنارة للاستشارات
www.manaraa.com

The author noted that most textbooks lean more to traditional methods of teaching. Van De Walle (2006) pointed out that traditional textbooks account for more than 80% of the textbooks that are now in schools. Researchers pointed out that traditional ways of teaching mathematics continue in the classroom across the United States (Dunn & Dunn, 2009; Van De Walle, 2006). The National Research Council (1989) stated that "Most teachers teach as they were taught, not as they were taught to teach" (p. 6). They also stated that "much of the failure in school mathematics is due to a tradition of teaching that is inappropriate to the way most students learn" (p. 6). Berry (2003) noted that most African- American students are not receiving instruction that is consistent with the NCTM, whereas white students are receiving instruction that is consistent with the NCTM. Most teachers were educated by traditional instructors who taught using traditional methods (McKinney & Frazier, 2008). Researchers have pointed out that many teachers as learners experienced traditional teaching in teacher-directed classroom settings (Spielman & Lloyd, 2004). The researchers stated that the teachers believe that the instructor and the textbook are the main authority in the classroom. Hart (2002) stated that pre-service teachers received their mathematical content by lecture and then received the methods courses by using reformed methods but very little reformed teaching methods are demonstrated. Lubinski and Otto (2004) stated that teachers will teach according to the way they were taught. In addition, they are also using the traditional-based methods because they have not had professional development in teaching standards based methods (Schoenfeld, 2002). Simon and Tzur (1999) stated that in order to reform mathematics education, educators should look at the way in which mathematics is being taught in schools, the type of mathematics activities students are involved in, and the teachers' perspective on learning and teaching mathematics. The authors stated that teachers need research-based understanding of how to transform from traditional teachers to teachers that will contribute and implement the current reform principles. Simon and Tzur (1999) pointed out that teachers

المنارة للاستشارات
www.manaraa.com

need to develop their knowledge in content of mathematics, understanding students' thinking, and the concept of their role as teachers. Teachers are faced with issues dealing with low SES students, gender differences, class differences, and ethnic differences. Teachers have been known to teach rote memorization and procedural skills to students that have these issues (Dunn & Dunn, 2009; Lubienski, 2000, 2002). Berry (2003) contended that these students continue to lag behind even after the No Child Left Behind mandate was enforced. Berry (2003) stated that even though there have been some gains in mathematics achievement, the gains have only been in the areas of basic skills and not in problem solving skills. Lubienski (2002) reported that there are gaps between African-Americans and whites in mathematics achievement and that this is attributable to the socioeconomic status (SES) difference between African-American students and White students. Lubienski (2002) reported that the lowest SES White students scored equal or higher than the highest SES African-American students. The author also reported that the 12th grade African-American mathematical performance was lower than that of the White 8th grade mathematical performance.

The Core-Plus Mathematics Project (CPMP) was designed to provide rigorous, conceptually- rich instruction to students. The curriculum provides ways for students to explore and investigate mathematical topics that relates to real-life situations. This exploration will eventually lead to deep mathematical knowledge and skills (Huntley, Rasmussen, Villarubi, Sangtong, & Fey, 2000). CPMP should be used to teach not only procedural skills but also conceptual understanding. Since, teachers may be using the textbooks to teach traditional content in a traditional way, the effectiveness of HSCE has not been documented. This study has demonstrated that students who are taught using the CPMP curriculum in procedural knowledge may show an increase in 9th grade student achievement in each of the three Algebra I units based on linear functions. Secondly, this study has demonstrated that students who are taught using the CPMP curriculum in conceptual knowledge may show an

المنارة للاستشارات
www.manaraa.com

increase in 9th grade student achievement in each of the three Algebra I units based on linear functions. This study has shown students' perceptions on the use of the CPMP. Finally, this study has shown that there is a difference in procedural and conceptual knowledge between male and female students in the treatment and control groups

Research Objectives and Questions

The main purpose of the present study is to determine if the effective use of the CPMP as a standards based curriculum results in an increase in 9th grade students' mathematics achievement. The urban school district requires every high school to use the same textbook, which is the *Algebra I*, McDougall-Littell. For the purposes of the study, the *Contemporary Mathematics in Context: A Unified Approach* (Core-Plus Mathematics Project, CPMP) textbook will be used in addition to the *Algebra I*, McDougall-Littell. Specifically, the CPMP course Unit 1 and 3, "Linear Models," was incorporated with *Algebra I*, McDougall Littell. These two textbooks were used simultaneously with the treatment group to demonstrate standards based teaching methods. Only *Algebra I*, McDougall-Littell was used with the control group to demonstrate a more traditional-based teaching.

Research Questions

The following research questions are addressed in this study:

1. Do students who are taught the CPMP curriculum score higher on procedural knowledge than students who are not taught the CPMP curriculum?
2. Do students who are taught the CPMP curriculum score higher on conceptual knowledge than students who are not taught the CPMP curriculum?
3. What are perceptions of students in the treatment group regarding the use of the CPMP methods?
4. Is there a difference in procedural and conceptual knowledge between male and female students in the treatment and control groups?

المنارة للاستشارات
www.manaraa.com

Significance of the Study

There is some evidence that the use of the standards based curriculum has a positive impact on students' learning mathematics (Goldsmith, Mark, & Kantrov, 1998; Senk & Thompson, 2003). A large number of textbooks that describe themselves as standards based look totally different from textbooks of 20, or even 10 years ago (Malloy, 2003). These textbooks include sections on problem solving and applied problems that involve practical uses for the mathematics students are learning. They cover mathematics topics that were not covered in previous years. Even though current textbooks have incorporated NCTM standards, the textbooks still do not meet the NCTM guidelines. So, there is a significant difference between the textbooks and the curriculum (Malloy, 2003).

Even though the Algebra I textbook is more aligned with the standards, it still lacks in providing more standards based problems. The importance of the study is to show that the CPMP curriculum has a direct relationship with academic achievement through standards based teaching methods. The standards based teaching methods are through a standards based curriculum known as the CPMP. Four assessments have been utilized during the study and the researcher has examined these assessments. These assessments have demonstrated the knowledge that the students have received from the CPMP, which was taught within the framework of the HSCE curriculum.

Overview of the Study

This study examined the effectiveness of the mathematics CPMP curriculum on 9th grade students in a high school, in a large city in the Midwest. Specifically, this study sought to determine if teaching high school mathematics from a standards based curriculum will produce high student achievement. Many researchers recommend the use of the new reform curriculum in teaching and learning of mathematics (Malloy, 2003; Schoen et al., 2003). Schoenfeld (2002, p. 17) stated that "standards based reform appears to work when it is

المنارة للاستشارات
www.manaraa.com

implemented as part of a coherent systemic effort in which curriculum, assessment, and professional development are aligned. Not only do many more students do well, but the racial performance gap diminishes substantially." This statement highlight that the use of standards based curriculum must be the focal point of instruction; otherwise standards based curriculum will not affect academic achievement.

Definition of Terms

Key terms used in this study are defined as follows:

Curriculum: Curriculum is a set of written expectations to express expected performance. It provides teachers with clearly defined statements of what students should know and be able to do as they progress through school. Additionally, it is a series of activities that students must do and experience by developing certain abilities so that they are able to conduct themselves in adult life (Bobbitt, 1918). Curriculum can also be described as all learning being planned and guided by schools, whether it is in the classroom, in the play area, or any other parts of the students' lives (Tyler, 1947).

Grade Level Content Expectations (2006) (GLCE): The No Child Left Behind mandate (2001) called upon states to implement grade level assessments based on rigorous academic standards by the 2005-2006 year. GLCE is a response to the nation's mandate. The GLCE documents are the third tier of the Michigan Curriculum Frameworks that are directly correlated to the items on the grade level MEAP assessment. The Michigan Curriculum Frameworks provides a three tiered program for a broader curriculum of what is to be expected to be taught and learned in Michigan schools. GLCE is more specific and clarifies what it is the students are expected to know and do on grade level assessments. The K-8 GLCE was written and developed to drive the formulation of 3-8 grade level tests.

High School Content Expectations (2006) (HSCE): HSCE provides educators and administers with a detailed set of expectations at each grade level 9-12 with the purpose of being aligned

المنارة للاستشارات
www.manaraa.com

with assessments. The HSCE was written and developed to drive the formulation of the Michigan Merit Exam.

Michigan Merit Exam: A State of Michigan exam administered to all 11th grade students. It has three components: 1) American College Test (ACT), 2) assessments of English language arts, mathematics, science, and social studies (Michigan component) and 3) a work skills assessment (WorkKeys). The ACT test results are sent to any college or university in the United States. The Michigan component of the test covers what is needed from the Michigan Curriculum Framework and Benchmarks for mathematics education. The Michigan Curriculum Framework is a resource for assisting Michigan's public and private schools design, enforce, and assess their core content area curricula. The WorkKeys is for students who have the desire to further themselves in college and/or the work environment.

المنارة للاستشارات
www.manaraa.com

CHAPTER 2

A REVIEW OF LITERATURE

Introduction

This review will take an in-depth look at the conception of testing and curriculum and the development of the GLCE and HSCE. In this chapter, the researcher will identify the learning theorists that guide this study. The researcher will also identify the problems educators face as they attempt to incorporate the HSCE with traditional methods of teaching. Discussions will include similar studies on the impact of standards based teaching on student achievement. There will be discussions on the type of instructional resources that are used in standards based teaching. The researcher will discuss previous efforts to bring about standards based teaching as it relates to student achievement. Other important issues that will be discussed in this chapter are teachers' and school systems' attempts to correlate the textbooks and/or other curriculum materials with the NCTM standards. Discussions will include prior research on the effects of standardized-based testing on the learning of disadvantaged students. Discussions will include social factors that may hinder educators from teaching reform methods of the curriculum. Finally, an important issue that will be addressed is the effects of teachers' attitudes on disadvantaged students.

Evolution of Testing

In the last 65 years, testing came to dominate the American education system. Testing derived from the economic and political rivalry of the United States and the Soviet Union, which began making advancements in technology more than the United States (Amrein & Berlinger, 2002). Because of the Soviet Union's advancement, federal policy makers began questioning the American education system; the federal policymakers wondered why United States did not think of making these advancements before the Soviet Union. Discussions lead to them making decisions on making changes in the education system. Consequently, some

المنارة للاستشارات
www.manaraa.com

states began implementing testing standards in their schools but found these standards were based on minimum levels of achievement. Eventually, Federal lawmakers eliminated the minimum competency tests and began the high-stakes testing movement. In response to the TIMSS study and the National Assessment of Educational Progress (NAEP), which obtains data to provide confirmation about the progress of the U.S. educational system, global and national standards were changed. These studies examined the 4th, 8th, and 12th grade students in mathematics and science. The TIMSS study (TIMSS-R, 1999) found that American 4th graders were above average, 8th graders were average, and 12th graders were below average.

In the early 1990s, some states such as, California, Colorado, Michigan, and New York, had adopted curriculum standards to raise the level of achievement for their students (Amrein & Berlinger, 2002). In 1993, the Michigan Department of Education collaborated with several representatives from state universities and with state funding developed a curriculum framework. The framework components consisted of English language arts, mathematics, science, geography, and social studies. The Michigan Curriculum Framework is a resource for assisting Michigan's schools to design, implement, and assess the curricula of their core content areas (Michigan Curriculum Framework, 1996). The framework includes three tiers. Tier I includes content standards and benchmarks for K-12 in all core content areas. The benchmarks have various developmental levels: early elementary school, later elementary school, middle school, and high school. Tier I also includes planning, teaching and learning, assessment system, professional development and executive summaries and a glossary. Tier II contains toolkits to assist districts with planning assessments and guidelines for incorporating principles associated with the learner, technology, and curriculum integration. Tier III contains content-specific resources to help with the curriculum development process (Michigan Curriculum Framework, 1996). The Michigan Curriculum Framework categorizes the benchmarks in developmental levels. It was necessary for the

المنارة للاستشارات
www.manaraa.com

Michigan Department of Education to align the benchmarks by grade levels in order to meet the requirements of the No Child Left Behind Act of 2001. Michigan collaborated with a bipartisan organization, *Achieve, Inc*., in making recommendations for improving Michigan schools. Through three benchmarks, *Achieve* was able to develop Michigan's curriculum. The curriculum is called the Grade Level Content Expectations (GLCE) for K-8 and the High School Content Expectations (HSCE) for grades 9-12 (Achieve, 2002).

The History of Educational Testing

The history of educational testing can be divided into four parts: testing prior to 1800, the nineteenth century, the half century between 1900 and 1950, and the time period from 1950 to the present. Prior to 1800, people tested human differences by measuring length, mass, and time in describing height, weight, and speed by using the length of a man's foot, the weight of a stone, and the sun gauge the time of the day. Early achievement tests were recorded by ancient Greece and Sparta in the proficiency of language and arts (Gerberich, 1963). Around 2200 B.C., the Chinese had written examinations for selecting public officials.

In 1845, Horace Mann introduced written tests in all Boston schools. These tests replaced the oral tests that were given to students by school committees (Gerberich, 1963). In 1887, physician Dr. E. Chaille understood the concept of mental age. In 1890, scientists, Binet and Henri pointed out that testing should be done on such functions as memory, attention, comprehension, and imagination (Gerberich, 1963).

Between 1900 and 1950, the development of testing was separated in three areas: (a) mental testing, (b) achievement measurement, and (c) personality evaluation. Testing on mental abilities was at first given individually then given in groups. The group tests on intelligence were first given to the U.S. army then to civilians. These tests were followed by aptitude tests and multi-score tests (Gerberich, 1963; Monahan, 1998). In 1905, scientists, Binet and Simon developed an intelligence scale where it interpreted the intelligence of

المنارة للاستشارات
www.manaraa.com

different children, at a specified age. The tests had various types of testing intelligence from a scale of least difficult to difficult. The *Stanford-Binet Intelligence Scale,* which included the concept of children's mental age, was published in 1916. The Alpha Army was a linguistic test designed to classify army draftees when the United States entered World War I. Army Beta was designed for illiterates and foreign speaking individuals (Gerberich, 1963).

Since the selecting and sorting of military personnel was useful to psychologists, educators and businessmen became enthused about testing civilians and children. Since 1918, educational testing was not used for educational purposes but for selecting and sorting students (Tyler 1974). Most people were unskilled or semiskilled workers in labor and business, and only 5% of the labor force (people that work outside the home) was engaged in professional occupations. Testing was used in schools and colleges to sort people, and those who had the most promise would get a better education. Testing was developed for grading purposes, classification, and other sorting functions. In later years, aptitude tests were developed and applied to examinations. Society only had positions available to those students that made considerable progress on their aptitude test. Employment in health care and educational services required at least a high school diploma. Since tests were used to obtain data for sorting, guidance, and admissions, there was a growing controversy in connection to educational opportunities (Tyler, 1974). While the concept of educational testing has been with the United States since 1918, it has never aroused as much controversy as in the last 20 years.

In 1904, E. L. Thorndike was responsible for the development of achievement tests. In 1908, one of Thorndike's students, C. W. Stone, developed the first standardized achievement test, on arithmetic reasoning. In the 1920's, achievement testing was used in a broader sense for educational institutions (Gerberich, 1963). Teachers were using these tests to measure learning outcomes.

المنارة للاستشارات
www.manaraa.com

Since the 1950's, significant improvement has been made in the upgrading of testing. In 1959, Project Talent, a research and testing program, was developed to improve testing methods and results (Gerberich, 1963). Also in 1959, Princeton's Educational Testing Service (ETS) devised tests to capture students' abilities, engage in research, and provide services (Monahan, 1998).

Evaluation of the Curriculum

The development of curriculum evaluation

In the early 1950s, archrivals, the United States and the Soviet Union were involved in a Cold War and at the same time, were discovering advanced technology. However, on October 4, 1957, Soviet Union's artificial space satellite, *Sputnik I* was successfully launched. November 3, 1957, *Sputnik* 2 was launched and carried the first living passenger to orbit, a dog named Laika (Garber, 2007; Launius, 2005; Naugle, n.d.; Smith, 2008; White, 1958). These technological endeavors caused the United States to realize that they were behind in the technological advances of the Soviet Union and also to further question the American education system (Amrein & Berlinger, 2002).

Amrein and Berlinger (2002) pointed out that in the early 1960's, many organizations, including the National Science Foundation, were engaged in the development of curriculum evaluation (Stake, 1967). In 1966, a professional organization, the American Educational Research Association (AERA), developed and refined curriculum evaluation. The committee members concluded that the current testing and inquiry procedures were insufficient and that observation, data-reduction, and decision-making procedures were essential (Stake, 1967). To give attention to the practice of evaluation in education, in 1966, AERA published the journal called the *AERA Monograph Series on Curriculum Evaluation* (Hamilton, 1977; Stake, 1967). The Monograph series is a journal that publishes topics such as merit in teaching, education

المنارة للاستشارات
www.manaraa.com

politics, and educational goals. These topics facilitated the development of curriculum evaluation.

In 1965, education research psychologists conducted a study on the achievement levels of students. In order to complete the study they received financial support through the federal Elementary and Secondary Educational Act. Based on the reports the federal administration received, curriculum evaluation became an entity for educational auditing (Hamilton, 1977). The federal administration controlled and operated the curriculum. In the early 1960s, Secretary of Defense, Robert McNamara, incorporated an evaluation format in his department called Planning, Programming, and Budgeting System. His innovation was based on a change from cost-effective measures that go into the budget to cost-effective measures that come from the budget (Hamilton, 1977). In 1965, all federal agencies and departments began using McNamara's cost-effective measures. By the end of the Vietnam War, no revenue was available for federal spending, and the evaluation was now looked upon as an auditing function (Hamilton, 1977). McNamera's cost-effective measures were eventually used for auditing purposes.

Change in National Standards

The need for continuing assessment of the progress of education comes from demands made upon the educational system. Data were needed to ascertain what students have learned and the proportion of students that learned each of the objectives the schools were teaching (Beaton & Zwick, 1992). The educational system needed an assessment that would evaluate trends in educational attainment over time (Johnson, 1992). Hence, in 1964, the National Assessment of Educational Progress (NAEP) was formed under the chairmanship of Ralph W. Tyler (Tyler, 1966). In 1969-70, the first assessment was made in the area of science, writing and citizenship (Johnson, 1992; Tyler, 1966). By 1974-1975, art, career and occupational development, literature, mathematics, music, reading, and social studies were added. In 1988,

المنارة للاستشارات
www.manaraa.com

Congress gave permission to NAEP to administer a Trial State Assessment program (TSA), which was held in 1990 and 1992 (Beaton & Zwick, 1992; Johnson, 1992). The TSA was designed to report findings for grades four and eight and subject areas for individual states that choose to participate in the program (Beaton & Zwick; 1992, Johnson, 1992). After each of the assessments was administered, NAEP would present its findings to all people interested in education. A recent summary of the NAEP trends showed that science, mathematics, reading, and writing, for 9, 13, and 17 years old students showed improvement from the 1970s to 1980s. However, in 1990, the trend showed that the students were at the same level or worse than the scores in the 1970s and 1980s (Beaton & Zwick, 1992,).

The "new math" was instituted in many U.S. schools in the 1950s and 1960s and turned out to be a total failure (Davis, 1990). Great controversy arose about the new math as soon as it was instituted. Critics claimed that it was too theoretical and used mathematical language that many teachers and parents did not understand. They believed that it abandoned basic skills and were concerned that with higher level learning that students' mathematics achievement would suffer (Davis, 1990). Soon after the NAEP reported its initial results, there was a back-to-basics movement which was criticized for being too narrow. The National Council of Supervisors of Mathematics (NCSM, 1977) called for mathematics to be taught more broadly than numerical computation and algebraic topics. The NCSM and NCTM together called for a major change in the curriculum where students would learn problem solving, applying mathematics, number sense, geometry, and data analysis (*An Agenda for Action*, 1980; *Curriculum and Evaluation Standards for Mathematics Education*, 1989; *Principles & Standards for School Mathematics*, 2000). These standards would be used with tools such as calculators and computers.

المنارة للاستشارات
www.manaraa.com

The History of the "New Math"

Before and during World War II, many German mathematicians and scientists migrated to the United States when Adolf Hitler became a super power (Walmsley, 2001). Their educational training was in pure and applied mathematics. The war highlighted that United States' survival was dependent on technology and the mathematics that would support that technology (Hayden, 1981). The use of operations research, which used programs, such as linear programming, game theory, and different methods of statistics, was used to win the war (Walmsley, 2001). Mathematics was slowly being recognized by the nation through the funds of National Science Foundation (NSF), which was contributing to universities and colleges (Hayden, 1981; Walmsley, 2001). In 1957, The Department of Defense noted that the development of computers and automation was developing faster than the universities and researchers and saw a need for further training (Walmsley, 2001). However, President Eisenhower was more concerned about social and international issues. In addition, the United States was involved in a Cold War and much of the focus was on international affairs and less focus was on education (Walmsley, 2001). The United States was not supporting science and mathematics to neutralize the forces of Russia. Even though, the public understood the importance of mathematics to the universities and their daily lives, they were confident in their technology and knowledge (Walmsley, 2001). When Russia launched the first satellite called, *Sputnik*, October 4, 1957, many people believed that Russia was more superior to the United States. The launching of *Sputnik* caused the promotion of mathematics education. Through the news media, the public heard about the "new math" and began to accept this new movement (Hayden, 1981; Walmsely, 2001). In the high school mathematics curriculum, the "new math" included such topics as, the use of sets, the study of numeration with different bases, the study of the commutative, associative, and distributive laws, trigonometry, the logical structure of mathematics, and the study of functions and relations (Hayden, 1981, p.

المنارة للاستشارات
www.manaraa.com

105). In 1950, NSF was created with funds of $15,000, however, after *Sputnik*; these funds were raised to $140,000,000. These funds were used to strengthen the study of mathematics and science. In addition, the monies were used to improve K-12 mathematics, science, foreign language, vocational programs, guidance counseling, and testing for gifted students (Walmsely, 2001). Many projects came into existence in the 1950s due to the increased pressure of college-bound students' wanting more higher-level mathematics. However, with the release of additional funds after *Sputnik,* more projects were developed. In the 1960s, textbooks began to include a "new" curriculum that was developed from many reform projects (Walmsely, 2001). The following is a list of major and minor projects.

- University of Illinois Committee on School Mathematics (1951)
- University of Illinois Arithmetic Project (1958)
- University of Maryland Mathematics Project (1957)
- Commission on Mathematics of the College Entrance Examination Board (1959)
- School Mathematics Study Group (SMSG) (1958)
- Greater Cleveland Mathematics Project (1959)
- Madison Project (1957)
- Comprehensive School Mathematics Project (1963)

The minor projects include:

- Developmental Projects at SIU (1958)
- Boston College Mathematics Institute (1957)
- SMP (1962)
- Nuffield Project (1964)
- Minnesota Mathematics and Science Teaching Project (1961)
- Ball State Teachers College Experimental Project (1955)
- The Suppes Project (1958)

المنارة للاستشارات
www.manaraa.com

- Other state and school projects

As the 1960s came about, the United States experienced social unrest concerning civil rights. It was noted that the public's interest had shifted from mathematics education to issues related to equal opportunity for all people (Walmsely, 2001). In addition, "*Sputnik* had made the reform programs from the 1950s look like failures" (Hayden, 1981, p. 211). Teachers and parents struggled with concepts, such as sets and numeration systems. Mathematics educators began to voice their doubts about the "new math" in public forums, such as the SMSG's Chicago Conference on Elementary School Mathematics in 1959 (Hayden, 1981). In the 1960s the "new math" movement was declining. Hayden (1981) stated that the "new math" was design for the advanced mathematics students and the mathematics was not available for all students. In addition, some of the pioneers of the reform mathematics died and the programs were disbanded. In the 1970s, the "new math" came to an end. One reason was because although the "new math" was a symbol for problem solving in the context of applied mathematics, it was not clearly demonstrated (Hayden, 1981). The "new math" of the 1950s and 1960s had not changed much since the 1930s and 1940s when Brownell, a psychologist with an interest in mathematics education, expounded that progressive education should include mathematics that is used in the real world (Hayden, 1981). Another reason is because after World War II, different NSF institutes brought teachers in contact with the new developments of the reform programs, then in the late 1960s and early 1970s, these institutes discontinued the programs and teachers received no more training. Another reason is before World War II, there was great interest in mathematics, science, and technology. In the 1950s, the United States interest was in outperforming Russia in science and technology. By the late 1960s and 1970s, the public was demonstrating against the Vietnam War and education. Mathematics and science were not as important as social issues, such as poverty and social injustices against groups of people (Hayden, 1981; Walmsely, 2001). Many parents were

المنارة للاستشارات
www.manaraa.com

dissatisfied with the "new math" because they believe it produced children that could not do simple mathematics (Walmsely, 2001). The post-*Sputnik* era ended. Government support for curriculum reform, NSF institutes, and the space program diminished (Hayden, 1981; Walmsely, 2001). Since support was reduced for training on curriculum reform and the "new math", teachers were unable to implement the "new math" projects.

President Nixon called for a nation reform where disadvantaged children receive quality education (Walmsely, 2001). President Nixon also called for more accountability within the school systems by using standardized testing. By the 1980s, National Council of Teachers of Mathematics (NCTM) saw that the influence of calculators and computer was changing, that there was an increase of statistics and probability topics included into the curriculum, and the mathematically-challenged students were using mathematics (Walmsely, 2001). NCTM published *Agenda for Action,* which addressed the need for more problem solving. So the back-to-basics was changed to higher critical thinking. The agenda that was published was the forerunner of the new standards. In 1989, NCTM launched new standards called the *Curriculum and Evaluation Standards for School Mathematics* and updated them in 2000 with *Principles and Standards for School Mathematics.* These standards are in conjunction with the current mathematical reform (Walmsely, 2001).

Change in State Standards

In 1960, there were three developments that generated considerable public controversy that impacted a changed way of thinking about assessment at the state level. The first development was the formation in 1964 of the NAEP (Tyler, 1966, Beaton & Zwick, 1992; Johnson, 1992). The second development was the Elementary and Secondary Education Act of 1965 (ESEA). The ESEA included Title I funds for supplemental programs for underachieving students, English-language learners, female students, and Native American students. Not only did ESEA provide funds for supplemental services, it provided funds for

المنارة للاستشارات
www.manaraa.com

students so that they may show academic improvement, which enabled them to reach adequate grade-level proficiencies (Linn, 2000; Thomas & Brady, 2005). In 1988, Title I was amended requiring states to define and document student achievement for disadvantaged students. In 1992, President Clinton's administration had a major reform called the Goals 2000: Educate America Act, which was passed by Congress in 1994 (Linn, 2000; Thomas & Brady, 2005). Goals 2000 included "greater academic accountability for students, increased local control, better teaching methods, and expanded options for parents," (Thomas & Brady, 2005, p. 55). The ESEA was later renamed the No Child Left Behind Act, 2001 (Thomas & Brady, 2005). The third development was the publication in 1966 of the Coleman Report on *Equality of Educational Opportunity*. This publication assessed the quality of service the schools were supplying to different segments of the population (Dyer & Rosenthal, 1974). Coleman found, through researching 600,000 students, that academic success was less related to students' schools and more related to students' family background, the environment, and the relationship they have with teachers (Kiviat, 2001; Kahlenberg, 2002; Hoy, Tarter, & Hoy, 2006). Coleman believed that black students that attended integrated schools would have higher test scores if the majority of the student body were white (Kiviat, 2001; Kahlenberg, 2002; Hoy et al., 2006). These three developments called attention to assessing the performance of schools and of the children who attend those schools. Even though three national undertakings were known, there were many states that developed programs of assessments for their schools. For example, Colorado, Michigan, Pennsylvania, California, Hawaii, and New York had begun broad range testing in basic skills. Since then, other states have followed suit.

The Change to High Stakes Testing

In recent years, test scores have come to dominate the outcome of schools and their accomplishments (Amrein & Berlinger, 2002). School policymakers, schools, principals, and

المنارة للاستشارات
www.manaraa.com

classroom teachers have consistently come under fire when test results are low. Many states evaluate basic skills of their students to see if schools are accomplishing educational and curriculum goals. For example, Florida implemented a statewide minimum competency tests that were a requirement to graduate. This state pointed out that there were differences among schools in the graduation requirements, hence an increase in dropout rates especially for minorities from low SES backgrounds (Amrein & Berlinger, 2002). Federal, state, and local leaders were dismayed with these findings. In the 1980's, the minimum competency test was eliminated. Due to other studies related to the poor education of students, in 1983, the National Commission on Education released the report, *A Nation at Risk*, the most prominent report on education in decades. A *Nation at Risk* called for an end to the minimum competency testing movement and began the high-stakes testing movement that would raise United States standards of achievement (Amrein & Berlinger, 2002). The committee for *A Nation at Risk* called for an increased requirement for all high school graduates. It called for three years of high school mathematics and required more challenging programs for college preparatory students as well as non-college preparatory students.

NCTM has primarily led reform for school mathematics education for the last 20 years. Even though NCTM has been the forerunner in the change of mathematics education for years, some teachers have not made the necessary changes in their teaching methods (Schoenfield, 2002). In 1989, NCTM published the *Curriculum and Evaluation Standards for School Mathematics*, which laid out the goals and foundation for school mathematics and recommendations for the content that should be included in the curriculum. The *Curriculum and Evaluation Standards for School Mathematics* articulates five goals for all students: "(a) that they learn to value mathematics, (b) that they become confident in their ability to do mathematics, (c) that they become mathematical problem solvers, (d) that they learn to

المنارة للاستشارات
www.manaraa.com

communicate mathematically, and (e) that they learn to reason mathematically" (NCTM, 1989, p. 5).

Soon after NCTM published the *Curriculum and Evaluation Standards for School Mathematics*, it published the *Professional Standards for Teaching Mathematics* (NCTM, 1991) and the *Assessment Standards for School Mathematics* (NCTM, 1995). The *Professional Standards for Teaching Mathematics* includes standards for the professional development of teachers, the evaluation of the teaching of mathematics, and the support and development of teaching and teachers. The *Assessment Standards for School Teaching Mathematics* includes recommendations for assessments to monitor students' progress, evaluate students' achievement, and make instructional decisions.

Between 1992 and 1998, NSF held a series of annual conferences, which included representatives of instructional materials development projects for K-12 mathematics to discuss how to develop materials for students' achievement in mathematics (Thompson & Senk, 2003). The instructional materials development projects for high school, funded by NSF, included the Core-Plus Mathematics Project, the Interactive Mathematics Program, MATH Connections, the Systemic Initiative for Montana Mathematics and Science, Integrated Mathematics Project (SIMMS IM), Applications/Reform in Secondary Education (ARISE), and Connected Mathematics (Thompson & Senk, 2003). Also included was the University of Chicago School Mathematics Project Secondary Component (UCSMP), which was supported by private funding. By 1999, over 300,000 high school students in the United States were studying mathematics textbooks funded by NSF and another 3 million students in the United States from elementary to high school studied materials from UCSMP (Thompson & Senk, 2003). The standards based textbooks are different from the traditional textbooks, because they use more realistic applications and less procedural computation. The standards

المنارة للاستشارات
www.manaraa.com

based textbooks allow for more computations to be done by calculators than the traditional textbooks. They are also designed for more cooperative learning and collaboration.

The Development of GLCE and HSCE

In 1995, Michigan adopted a model core academic curriculum to establish a common set of expectations for all of Michigan school children. The Michigan Curriculum Framework was published in 1996 to reveal expectations to Michigan educators and provide them with necessary tools for aligning curriculum and classroom practices with the state standards (Michigan Curriculum Frameworks, 1996). In 2002, the State Board of Education requested that the Michigan Department of Education develop grade-by-grade expectations in Reading/Language Arts and Mathematics for grades K-6. These grade-by-grade expectations would provide a clearer guidance to educators and parents and serve as the basis for annual assessments required by the federal No Child Left Behind Act (NCLB) of 2001(Thomas & Brady, 2005; Michigan Department of Education, 2007). The act mandated the existence of a set of comprehensive state grade level assessments that are designed based on rigorous grade level content. Committees were formed and the new expectations were subjected to a process of reviews to assist with the resulting content expectations that would be among the best in the nation. The Governor of Michigan and Superintendent of Education asked *Achieve* (1996), to conduct an external review of the English/Language Arts and Mathematics expectations and compare them to the best in other states and nations. *Achieve* is an independent, bipartisan, nonprofit organization created by governors and corporate leaders to help raise standards and performance in American schools and to provide recommendations for improvement. *Achieve's* criteria for high-quality of standards for students learning included:

- Rigor of state standards
- Clarity of language that is accepted by educators, parents, and others
- Specificity to convey the level of performance expected of students

المنارة للاستشارات
www.manaraa.com

- Focus on the amount of content to be learned in each grade level to be manageable
- Progression of knowledge that is built from previous experience and increase in intellectual demand yearly.

The reviewers of Michigan's final Draft 2003 K-8 Grade Level Content Expectations in Mathematics used three sets of *Achieve's* Benchmark Standards: Singapore (2001), Massachusetts (2002) and Achieve's end of grade 8 expectations in *Foundations for Success* (2002).

According to National Center of Education Statistics (NCES, 2003), the 1999 Third International Mathematics and Science Study-Repeat (TIMSS-R) is a successor to the 1995 TIMSS that focused on the mathematics and science achievement of eighth-grade students in 38 nations. The TIMSS-R study only focused on the mathematics lessons. According to the TIMSS-R study (1999), it named Singapore, the Republic of Korea, Chinese Taipei, Hong Kong SAR, and Japan as the top performing countries in mathematics at the 8th grade levels. The United States was ranked 19th in the mathematics achievement of its eighth-grade students. Also the study named Chinese Taipei, Singapore, Hungary, Japan, and the Republic of Korea as the top performing countries in science at the 8th grade levels, while the United States ranked 18th in the science achievement of its eighth-grade students. TIMSS-R (1999) found patterns between other countries and the United States. According to the TIMSS-R study (1999), the 1995 TIMSS assessment confirmed that U.S. fourth-graders performed above average in both mathematics and science in comparison to students in other countries. It revealed that U.S. eighth-grade students' performance was average in both mathematics and science. The TIMSS-R study (1999) revealed that the U.S. twelfth-graders scored below the international average and among the lowest of all of the nations in mathematics and science, as well as in physics and advanced mathematics. Since Singapore scored at the top of the

المنارة للاستشارات
www.manaraa.com

international mathematics and science, the educational world was interested in Singapore's mathematics program and curriculum.

Massachusetts is the top performer in mathematics and science in the United States. Its District of North Middlesex Regional School began using the Singapore math curricula in 2000, and since then, most of the schools in Massachusetts have adopted it. Massachusetts has a standardized assessment called the Massachusetts Comprehensive Assessment System (MCAS) which is a graduation requirement for the state's high school seniors. According to Driscoll (2006), in 2002, 55 percent of the seniors passed the test. In 2003, 72 percent, and after retesting, 95 percent of the class passed the test (Driscoll, 2006).

Achieve developed a document called F*oundations for Success: Mathematics Expectations for the Middle Grades*, 2002. They discovered that students are competent to perform straightforward mathematics, but most of them do not have a firm understanding of the fundamental concepts. *Achieve* (2002) realized that to improve student performance, there should be some changes in approaches to learning. The approaches to learning include:

- Using the assessment results to assist teachers to improve teaching practices.
- Measuring student proficiency on a regular basis.
- Supporting teachers by giving them the knowledge and skills needed to raise student proficiency.

Achieve (2002) partnered with Mathematics Achievement Partnership (MAP) to reaffirm the TIMSS data by using tests of 21 states of fourth and eighth grade students. It acknowledged that more than half of the eighth grade test items dealt with computations, fractions, and whole numbers. These are procedures that students from other countries have mastered before the seventh grade. Top performing countries include congruence, similarity, functions, equations, two-and three dimensional geometry. Tests in the United States barely include these concepts, if at all. The TIMSS study, the National Council of Teachers of

المنارة للاستشارات
www.manaraa.com

Mathematics (NCTM), the *Achieve* analysis, and the Massachusetts curriculum laid the groundwork for MAP. The documents include achievement in mathematics that requires procedural knowledge, conceptual knowledge and problem solving. MAP recognizes that by the end of the eighth grade, U.S. students will learn more mathematics with the new curriculum than they are currently learning (Achieve, 2002).

Schwartz (2006) explained that curriculum writing needs a new approach, intended to educate teachers rather than students. *Achieve* had this approach in mind when they developed Michigan's curriculum. *Achieve* laid the groundwork for the Michigan K-8 Grade Level Content Expectations (GLCE). GLCE (2006) is a document that guides curricular and instructional ideas, provides professional development needs, and gages student achievement.

The writers of GLCE believe that content knowledge alone is not enough for academic success. They believe that students should apply their knowledge to new situations, to solve problems by generating new ideas, and to make connections between what they learn in the classroom and the world around them. In 2004, the Michigan Department of Education saw a need to create content expectations for high school students that reflect both rigor and relevant curriculum focus. These standards are closely aligned with the ACT's College Readiness Standards (2002), NCTM's *Principles and Standards for School Mathematics* (2000), and the 2003 National Assessment of Educational Progress (NAEP).

The Performance of GLCE and HSCE

Over the past several years, the citizens of the United States have criticized the educational system. One of the factors that led to the criticism is the poor performance in mathematics and science in the TIMSS study (Jones, 2005). Colleges and employers have demanded that the federal and local governments and districts produce a rigorous curriculum that includes complex, high-level thinking skills that may be applied to college studies and in the work place. There is a gap between the knowledge and understanding of mathematics that

المنارة للاستشارات
www.manaraa.com

the curriculum gives and the implementation of that knowledge and understanding of mathematics in the classroom. Compounding this problem is that differences in ethnicity/race, class, and gender, teacher effectiveness and preparation, may compromise learning. These factors may hinder the learning process for many students (Campbell, 1988; Lubienski, 2000; McGraw, Lubienski, & Struchens, 2003; Hoy, W., Tarter, & Hoy, A., 2006; Lubienski, S. T. & Lubienski, C., 2006; Pearce, 2006; Stinson, 2006). In addition, teachers use procedures and rote memorization instead of adding relevance and rigor to their teaching methods (Drake, 2007). Since 1983, states and school districts have tried many approaches to raise their students' test scores, and educators are willing to try almost anything if it has the potential of increasing achievement (Jennings & Rentner, 2006). Armed with this notion, the Michigan policyholders formulated the GLCE of 2004. The performance assessment of the HSCE is the standardized test called the ACT/Michigan Merit Exam (MME). HSCE measures academic success in the following disciplines: mathematics, science, ELA (English Language Arts)/reading, and social studies.

Culture affects students' academic success in these disciplines. Lubienski (2000) did research where she explored ways in which a standards based curriculum (Connected Mathematics Project) was used with her 7th grade students. Lubienski (2000) discovered that students from higher SES backgrounds tended to display confidence and solve problems with an eye toward the mathematical content, while those from lower SES backgrounds preferred more external direction and sometimes their approach to problems caused them to miss the intended mathematical points. She concluded that further research is needed on class differences. Data from decades earlier, made assumptions that middle-class mothers did not work outside the home. Lubienski (2002) also concluded that inquiries should be made into the interactions of ethnicity and gender. Lubienski (2002) attempted to examine the gaps that were attributable to SES difference between African-American students and whites in NAEP

المنارة للاستشارات
www.manaraa.com

mathematics achievement between the years of 1990 and 2000. The author also explored factors that may have been attributable to these gaps. Lubienski pointed out that, white students of higher SES experienced curriculum that supported the NCTM. However, the African-American students experienced more mathematics through rote-memorization, which is moving towards a more traditional style of teaching. Lubienski (2002) stated that it is possible that since teachers have low expectations of African-American and low SES students, they only teach them the basic skills. Another explanation is teachers are attempting to respond to the expectations of African-American students' cultural background by teaching rote memorization rather than problem solving (Lubienski, 2002). The author noted that in order to implement reform curricula, more studies are needed to address the needs and strengths of African-American students or low SES students. McGraw, Lubienski and Struchens (2006) wrote on gender differences in mathematics achievement and attitude based on the U.S. National Assessment of Educational Progress (NAEP) analysis from the years of 1990 to 2003. McGraw et al. (2006) also found that in 2003, males scored higher on average than females at both the 4th- and 8th- grade levels. The authors also found significant difference in the mathematics scores of Whites and Hispanics but no significant difference for African-American students. There were significant differences for males Hispanics and White 4th- and 8th in the strands of measurement, numbers, and operations. There were significant differences with the content strands for African-American students but these difference favored females in geometry. The authors noted that they were not able to analyze 2003 NAEP data for interactions among gender, race/ethnicity, and SES to determine if gender and race/ethnicity is an underlying factor. McGraw et al. (2006) stated that it was necessary to have further research gender, race/ethnicity, and SES to further understand the relationships between student attitude and performance. Stinson (2006) researched gaps in mathematics achievement between African-American students and White students. Stinson (2006) noted

المنارة للاستشارات
www.manaraa.com

that in the past, there has been a lack of data on African-American and other minority students' mathematical experience. Boaler (2006) pointed out that there is a growing number of researchers in the mathematics community that have suggested expanding research beyond mathematics education research to understand more fully the outcomes of these students. Researchers state that studies on SES and ethnicity/race are important and should be recognized in order for the present curriculum reforms to exhibit achievement for all students (Boaler, 2006; Stinson, 2006). Campbell (1988) explained that the curriculum should include ways in which teachers can encourage all students, especially the poor, minorities, and both males and females.

GLCE and HSCE assist students to possess personal, social, occupational, civic, and quantitative literacy. Mastery of the knowledge and skills will increase the likelihood of students' academic success. The performance indicator, the Adequate Yearly Progress (AYP), is the goal where all schools must reach 100% proficiency on the state assessment by 2014. In the NCLB Act of 2001, all three aspects of the following must be met by the 2014-2015: Highly qualified teachers, Adequate Yearly Progress, and high achievement for all minority students. With these aspects in place, the GLCE and HSCE are expected to promote academic achievement.

The Conception of the Curriculum

The curriculum can be pushed beyond the basics to more in-depth, problem-oriented mathematical thinking. It is possible to teach for understanding without sacrificing procedural skill. NCTM states that a well-balanced mathematics program should be combined with facts, procedures, conceptual understanding, applications, and problem solving (Huntley, Rasmussen, Villarubi, Santong, and Fey, 2000; Knapp, Shields, and Turnbull, 1995; NCTM, 1989, 1991; Schoen, Cebulla, Finn, and Fi, 2003; Schoenfeld, 2002; Malloy, 2003). Hiebert and Lefevre (1986) reported that procedural and conceptual understanding should be taught to

المنارة للاستشارات
www.manaraa.com

students. They defined conceptual knowledge as knowledge that is rich in relationships, a connected web of knowledge, two pieces of information that have been stored in memory or existing knowledge and one that is newly learned. An example of a conceptual problem is:

> City Telephone Company charges $9.00 per month plus $0.15 per call. Alex Telephone Company charges $15.00 per month plus $0.10 per call. For both companies, the monthly charge is a function of the number of calls made.
>
> a. Write linear equations giving the relations between number of calls and monthly charge for each company.
>
> b. Compare the monthly charges by each company for 95 calls.
>
> c. How many calls could you make in a month for $40 under the pricing plans of the two companies?
>
> d. For what number of calls is City Telephone more economical? For what number of calls is Alex Telephone more economical?
>
> e. Which plan would cost less for the way your family uses the telephone?

Hiebert and Lefevre (1986) defined procedural knowledge as formal language that is a symbolic representation system of completing math and algorithms (rules) for completing the mathematical tasks' in step-by-step instruction. An example of a procedural algebra problem is:

> Use the substitution method to solve the linear system.
>
> a. $2x + y = 4$
>
> $-x + y = 1$
>
> b. $-3a + b = 4$
>
> $-9a + 5b = -1$

These theorists reported that conceptual knowledge and procedural knowledge can be integrated. Procedural knowledge translates conceptual knowledge into something observable.

المنارة للاستشارات
www.manaraa.com

Procedural and conceptual knowledge are embedded in the HSCE curriculum. Its goal is for all students to have an equitable education, but questions could be raised of whether all classes and both genders of students have been included, or if HSCE is geared primarily toward highly motivated, middle- to high-SES students that are in private or technical schools. Bobbitt (1918) stated American students will eventually become productive members of society, and schools should be prepared to reach every student so that each will be able to earn a living. The standards based curriculum is designed to include all students in learning mathematics with emphasis on the real-world applications around them. Bobbitt (1924) wrote that American society has difficulty with economic and community problems because Americans have not been trained to see and think quantitatively in practical life. Bobbitt (1924) wrote that schools and educators need to apply what is learned in the classroom to students' everyday experiences. This way, students can make mathematical connections to their lives. Since HSCE is a standards based guideline, teachers should be able to connect the standards based curriculum to students' everyday experiences.

Doll (1993) envisioned the teacher's role to be transformative not causal. He defined post-modern framework as a curriculum that is innovative and revolving and that it must be combined with the scientific and aesthetic, never going back to conservative values and views. Doll explained that in order for the curriculum to include the post-modern view, it should include richness, recursion, relations, and rigor. The author explained further that the curriculum should have depth and meaning (richness) without losing its form. It should also include a continuous reflection of the thought process (recursion). Doll's theory on post-modernism is projected in the HSCE. When the development of the curriculum occurred, the policyholders and educators had similar goals to Doll's theory: it should include rigorous state standards; the language must be clear for educators, parents, and students; it must convey the performance expected of students and maximum content to be learned; and knowledge must

المنارة للاستشارات
www.manaraa.com

be built on students' prior knowledge. According to Schimdt and Prawat (2006), there is a direct relationship between students being exposed to consistency and rigor in the curriculum and their performance on national standardized tests, such as those used in the TIMSS's study.

According to Pulaski (1980), Jean Piaget, the socio-cultural theorist, sheds light on understanding children's intellectual growth. Piaget studied the cognitive development of humans so that humans may understand what to expect from children. In 1918, Piaget was a biologist who studied the explanation of knowledge. His position was that each person was in interaction with his environment and that humans receive knowledge from seeking it, putting it in order, and assimilating it into their past knowledge (Pulaski, 1980). Piaget's contributions led to characteristics of the theory of knowledge: adaptation and organization (Pulaski, 1980). Piaget explained that adaptation takes place when humans organize their environment into a cohesive structure, such as a child incorporating a system where he can separate and label a rock collection (Pulaski, 1980). Adaptation has two parts: assimilation and accommodation. Piaget wrote that assimilation and accommodation are where individuals include ideas, values, and tastes and make them their own, such as a when young child listens to adults around him, learns the tones, the phrasing, and the meaning of the language and slowly makes it his own (Pulaski, 1980).

Unlike Piaget, Lev S. Vygotsky was an educator and he became a psychologist. Vygotsky's theory of development is different from Piaget in that Vygotsky's theory of development is interrelated with education. Vygotsky is known for the concept called the zone of proximal development. According to Mott (1990), Vygotsky developed the concept of the zone of proximal development in relation to IQ testing. Vygotsky "wanted to study the formation of processes by analyzing the subjects engaging in activities" (Mott, 1990, p. 4). Piaget's and Vygotsky's theories of development lend themselves to the need to study how today's educational practices either constrain or facilitate thinking (Mott, 1990). It is

المنارة للاستشارات
www.manaraa.com

necessary to create more rigorous guidelines so that teachers and children can be creative in their studies (Mott, 1990). The zone of proximal development reminds educators "that there is nothing "natural" about educational settings (and about educational practices, such as ability groupings, tracking, and other forms of stratification" (Mott, 1990, p. 15). These settings can be changed by recognizing class, gender, and ethnicity. These factors are imperative when educators are expecting students to learn from a rigorous curriculum so that they reach high achievement on standardized tests. Vygotsky's theory was based on the change and growth of a child. According to Vygotsky, a task is not completed until the child has learned the meaning behind the task (Frawley, 1997).

Jerome Bruner (1960) noted that discovery, intuition, translation, and readiness make up a natural process of learning. Teachers use many methods to stimulate for discovery. He believed that discovery was a process of working rather than a product discovered. He stated that there were two approaches to problem solving which were direct opposites of each other, the listener and the speaker. The listener's approach is to receive the information and discern a pattern to the information. The listener tends to fall behind on the message given, and attempts to puts all the information together along with what information is coming in immediately. The listener is forced into a passive role since he does not have total control of the direction of the message that is coming to him. On the other hand, the speaker's approach is to determine the order of the information that is received and is ahead of the message that he is receiving. Bruner (1960) observed that intuition is the next process of learning. Intuition implies the act of grasping the meaning or significance of a problem without explicit reliance on the analytic apparatus of one's craft. It yields educated guesses that precede any proof. From a psychological point of view, a student constructs an "internalized set of structures for representing the world around us" (p. 614). This student has mathematical principles that are newly acquired and original. He may not be able to verbalize his actions but will be able to

المنارة للاستشارات
www.manaraa.com

sort them according to his own understanding. Teachers should have students use their natural and intuitive ways of thinking and continue to encourage them to do so. Bruner (1960) stated that translation is an intricate step to learning mathematics. Translation is associated with three problems: Problems of structure, problems of sequence, and problems of embodiment. The problem of structure derives when a teacher attempts to transmit understanding to the students, but the students have difficulty understanding the message and have even more difficulty trying to explain it to someone else. In order for students to understand concepts, teachers themselves must understand those concepts. They must transmit their understanding to students in terms they understand so they can explain the concepts to someone else. The problems of sequence arise when teachers fail to move students from their present understanding to a higher level of thinking. Bruner (1960) refers to Piaget where he states that there are necessary steps in the mastery of a concept, such as points to lines to rays to angles to triangles. The problems of embodiment arise when understanding does not exist in a clear forum. Curriculum should not be taught in a step-by-step approach but should be spiraling in ideas and concepts, developed and explored until complete mastery by the student is accomplished.

Bruner (1960) believed that once teachers decide what information they want to transmit, then they should allow students a sense of their growth and their own capacity to jump ahead in mastery. HSCE allows teachers to use standards based methods to enhance students' knowledge and understanding. According to Bruner (1960), teachers should be able to facilitate learning so that students are able to explore and exchange ideas in order to receive a deeper understanding of concepts.

The Practice of Constructivism

In constructivism, students are not passively absorbing information but are actively involved in constructing meaning from their experiences and prior knowledge (Bruner, 1960;

المنارة للاستشارات
www.manaraa.com

Cobb, 1994). Students not only receive information, but make sense of the knowledge they received (Davis, 1990). The knowledge that they receive is with the assistance of teachers and educational institutions. Students must make connections with past understandings, at times modifying or discarding prior conceptions if they are not accurate (Cobb, 1994). They must build understanding that becomes part of their conceptual framework or actions.

Teachers assist students to develop a deeper understanding and promote active learning with hands-on activities that emphasize process (NCTM, 1991; Malloy, 2003). Teachers must provide a range of activities with class discussion designed to elicit competing points of view (Lubienski, 2000). They must encourage multiple approaches to problem solving (Bruner, 1960; Malloy 2003; NCTM, 1991). Teachers should utilize technology to promote student investigation and problem solving (Schoenfeld, 2002). They must be aware of common student misconceptions and model strategies for confronting student misconceptions (Lubienski, 2000). To further avoid misconceptions, teachers must use familiar examples, motivating experiences, and intriguing questions to engage students and apply them to the experiences of the student (Malloy, 2003). The experiences of the students may include developing awareness of the influences of their linguistic, ethnic, cultural, socio-economic backgrounds, and gender (Moussiaux & Norman, 1997; Schoenfeld, 2002).

Learning depends on context. Teachers may integrate problem solving and higher order thinking skills into subject matter units rather than teaching these skills in isolation (Malloy, 2003; Schoenfeld, 2002). They must also integrate learning across subject areas and within the discipline. For example, to promote critical thinking skills, one could include rates and proportions as they relate to reading notes in music (Skemp, 1987).

Teachers should advocate collaboration in the learning process, develop students' social skills and use cooperative group work strategies, in addition to the more traditional individual and competitive methods (Malloy, 2003). This will encourage students to reflect on

المنارة للاستشارات
www.manaraa.com

their ideas and contribute to the class activity. Teachers should meet students where they are and help them move to higher levels of knowledge and understanding (Malloy, 2003). This is done by using inquiry methods, open-ended questions and problems, realizing that the means to go about solving a problem is not fully specified in advance. Teachers should assist students to self-assess their learning and encourage them to take responsibility for their own learning. They should answer students' questions with other questions and direct students to resources other than the teacher and the textbook.

Continuous assessment facilitates learning by two-way discussions and performance assessments. There are a wide variety of assessment strategies, such as: projects, portfolios, learning logs, journals, constructed responses, observations, student interviews, peer evaluation, and self-evaluation (Bobbitt, 1924, Tyler, 1974). Assessment and instruction is never inseparable. Teachers should regularly communicate with other teachers (Hopkins, 1993). Teachers should always take risks, and explore and be current with up-to-date technology.

Teachers should use these constructivist ideas to produce student learning. In producing student learning, teachers should consistently reflect on their knowledge of mathematics, strategies of how best to teach mathematics, their interactions with students, and assessments given to students (Malloy, 2003). This could be done by teachers using the HSCE guideline in conjunction to standards based curriculums, such as the Core-Plus Mathematics Project (CPMP).

Discussions on Core-Plus Mathematics Project

The National Council of Teachers of Mathematics (NCTM) and the Mathematical Sciences Education Board (MSEB) called for a change in high school mathematics curricula, instruction, and assessment (Huntley, Rasmussen, Villarubi, Santong, & Fey, 2000). The change in the design of curricula included emphasis on students being engaged in the

المنارة للاستشارات
www.manaraa.com

exploration and investigation of mathematics where they work collaboratively to solve problems and assess their learning through different practices that are included in classroom activity (Harris, Marcus, McLaren, & Fey, 2001; Huntley et al., 2000; Malloy, 2003; Schoen, Cebulla, Finn, & Fi, 2003). This new approach in mathematics is based on the *Curriculum and Evaluation Standards for School Mathematics* (NCTM, 1989; Huntley et al., 2000; Malloy, 2003). One curriculum that models these standards is called the Core-Plus Mathematics Project (CPMP). CPMP was funded by NSF in 1992 to create a four-year integrated mathematics curriculum that builds on investigations of real-life contexts that lead to the discovery of mathematics in ways that make sense to students (Thompson & Senk, 2003). The mathematical lessons span 4 to 12 days and focus on interrelated mathematical concepts (Schoen et al., 2003). The students launch and explore in a small group investigation where they typically use tables, graphs, and graphing calculators. In collaborative situations, students are able to share responsibility and check their own understanding (Feathers, 1993). Then students share and summarize their findings in full-class discussions (Harris et al. 2001; Schoen et al., 2003). Finally, they apply their findings and reflect on their conclusions. This problem investigation approach allows students to explore mathematics graphically, algebraically, numerically, and symbolically.

The curriculum from Course 1 of the CPMP textbook includes students' investigating a sequence of questions to promote exploration (Schoen, et al. 2003). Teachers are greatly encouraged to attend professional development where they sample the CPMP curriculum and reflect on their experiences and then proceed with best practices to teach the lessons (Lappan, 1997; Schoen et al. 2003). Teachers facilitate students' efforts as they work flexibly toward mathematical goals (Harris et al., 2001; Schoen et al., 2003). Interrelated mathematical concepts or main ideas that connect with students' prior knowledge are embedded in the lessons (Malloy, 2003). Students work collaboratively in small groups or pairs, and class

المنارة للاستشارات
www.manaraa.com

discussions follow with teachers moderating the discussions (Schoen et al., 2003). Students assess their understanding of the main ideas, and at the end of the lesson, teachers measure students' understanding of concepts methods and skills (Harris et al., 2001; Schoen et al., 2003; Malloy, 2003). Graphing calculators are embedded in the curriculum as an integral part of instruction (Huntley et al., 2000).

Publishers' Drive to Market Traditional Textbooks

According to Reyes (2001), the publishers of textbooks face a daunting task to align the textbooks with the national standards. These factors are: (a) every state has its own frameworks and benchmarks that impacts what content is being taught, (b) approximately half of the states have committees that review and approve textbooks, (c) the other half of the states (sometimes, districts and schools) choose their own textbooks, (d) most districts adopt new mathematics books within a five- to seven year cycle, but there is no single time when all schools are adopting textbooks, (e) the use of technology, that is calculators and computer, varies greatly, (f) a shortage of mathematics teachers, and (g) a lack of deep mathematical content from many mathematics teachers that limit the curricula that can be developed (Reyes, 2001). In addition, the publishers, driven by sales, markets large volumes of books to encompassed the different frameworks of the states, districts, and schools (Reyes, 2001; Van De Walle, 2006). The decisions about the textbooks are made by educators who are being pressured by assessments. Many of them have limited background in mathematics and the NCTM standards (Reyes, 2001; Van De Walle, 2006). Productions of textbooks cost millions of dollars, so publishers look at bestsellers of certain textbooks and copy their strongest features (Reyes, 2001). Of course, it does not take into account what is needed for students. Reyes (2001) found that most textbooks have not been researched and field-tested with children and teachers before being released to school districts. Publishers' deadlines made it impossible to do extensive field-testing with teachers and children. Because of the market

المنارة للاستشارات
www.manaraa.com

demands of publishing textbooks, it was unreasonable to have teachers use the materials for several years and revise them based on student achievement and teacher feedback (Reyes, 2001).

Funds from NSF support standards based curricula. There has been field testing for the past 10 years. The testing have been piloted, tested, and revised in classrooms. The publishers of standardized-based curricula are required to document the materials they have on student performance. One of the examples of testing of standards based curricula is the CPMP. After the pilot test of the first CPMP course materials was completed in 1992, national field test began with Course 1 in 1994-95, Course 2 in 1995-96, and Course 3 in 1996-97 (Huntley et al., 2000). CPMP collected and analyzed data on students' learning of algebra on the traditional curricula and the standards based curricula. Researchers found students perform better in algebra using the standards based curricula (Huntley, et. al., 2000; Schoen, Finn, Finn, & Fe, 2003). Connected Mathematics Project (CMP) is another example of curricula that was field-tested. This curriculum was also funded by the NSF to create problem-centered material aligned with the NCTM standards. CMP analyzed data and found that standardized-based curriculum proves promising for low and high SES students (Lubienski, 2000).

Discussions of Similar Studies on the Impact of Standardized-Based Teaching on Student Achievement

For mathematics educators, NCTM standards offer insight of the curriculum and instruction that is both promising and demanding. Teachers are encouraged to involve their students in exploration and investigation (Spielman & Lloyd, 2004). Research has found that teachers struggle with the current reform methods because they do not possess sufficient depth of understanding in the content of mathematics (Schoenfeld, 2002; Spielman, & Lloyd, 2004). Researchers noted that in order to design and implement great opportunities for teaching, mathematics teachers need to understand how to develop from traditional teachers to teachers

المنارة للاستشارات
www.manaraa.com

that contribute to current reform principles (Simon & Tzur, 1999). Teacher development, which demonstrates a reform from traditional principles to reform principles, requires teachers to develop their knowledge in mathematical content, understanding the thinking of students, and understanding their roles as teachers (Simon & Tzur, 1999; Villegas-Reimers, 2003).

Ladson-Billings (1994) stated that there are five areas that are important in educating multicultural students: (a) beliefs about students, (b) content and materials(c) teacher education, (d) instructional approaches, and (e) educational setting. The author stated that some teachers expect more from white students and middle class students and expect less from African-American students and working- or lower-class students. They perceived African-American students as been incapable of academic achievement (Ladson-Billings, 1994). Teachers may perceive multicultural education to be trivial and may only acknowledge it during celebrations and holidays. Researchers noted that multicultural education should not be separate but should be integrated in the curriculum (Berry, 2003; Ladson-Billings, 1994; Lubienski, 2000, 2002). Teachers should include cultural variations in the pre-service preparations. Students that are not exposed to diverse groups in the classroom are likely to develop stereotypes about certain groups. Teachers should make changes to provide more equity in the instructions (Berry, 2003; Ladson-Billings, 1994; Lubienski, 2000, 2002; Schoenfeld, 2002). Changes may include having cooperative learning, usage of language, spend time in the community, and apply it in the classrooms (Ladson-Billings, 1994). Students of color should have high-quality education and not be segregated based on tracking or grouping. Teachers should include the equity of students and instruction when using standards based methodologies. Using the HSCE curriculum in connection with standards based teaching may bring about cohesive groups of students that are interested in learning.

Spielman and Lloyd (2004) did a study on prospective teachers learning and using the reformed curriculum materials. The researchers used CMP and Mathematics in Context

المنارة للاستشارات
www.manaraa.com

(MIC). The research was based on the change of traditional beliefs to reform beliefs of teaching. The authors pointed out that many teachers believe that the instructor and the textbook are the principal authority of mathematics subjects. They also pointed out that many teachers believe that the learning is done through procedural skills and not on conceptual understanding (McKinney & Frazier, 2008).

Researchers found teachers' beliefs about effective classroom practices changed during the semester as they used the reformed methods of teaching (Spielman & Lloyd, 2004). Boaler (2002) did a study on the relationship between the standard-based curriculum and equity of students. The author stated that teachers tended to offer working-class students more structure and presenting mathematics as facts and rules. The author demonstrated that students could develop conceptual understanding with structure. He stated that by teachers facilitating the lessons, students were able to show student achievement. Boaler (2002) noted that teachers that were aware of students' with low SES or low achievement levels provided open-ended problems that students could understand. Researchers stated that open-ended approaches to mathematics bring about not only a level of performance but a more equitable achievement (Boaler, 2002; Lubienski, 2000).

Researchers noted higher SES and White students tended to perform higher than the lower SES and minority students and suggested that in order to close the achievement gap between the two groups, teachers should understand the cultural differences that could be related to students' approaches to learning (Berry 2003; Hoy, Tarter, & Hoy, 2006; Kohr, Masters, Coldiron, Blust, & Skiffington, 1988; Ladson-Billings, 1994; Lubienski, 2000, 2002; Schoenfeld, 2002).

McKinney and Frazier (2008) investigated the mathematics pedagogical and instructional skill of teachers who teach disadvantaged students in middle schools. They developed a survey that identified forty-four instructional practices for teaching mathematics

المنارة للاستشارات
www.manaraa.com

and allowed participants to include other practices that were not included on the survey. The authors found that a "high percentage of teachers continue to teach mathematics through lecture, directed instruction, and drill and practice" (McKinney & Frazier, 2008, p. 208). The authors noted that there should be a balance between procedural knowledge and conceptual understanding. The authors also noted that professional development and university course work in mathematics pedagogy and teaching disadvantaged students may have a more positive impact on student achievement.

In conclusion, there is positive growth in student achievement when teachers use standards based methodologies (Huntley, 2000; Schoen, et. al, 2003). The growth in student achievement is associated with the curriculum and teaching practices was consistent with students SES levels, ethnic mixes of the school population, beginning achievement levels of students, lengths of classes, and the number of students enrolled in classes. Also professional development that accompanied a curriculum can strengthen the practices and behaviors of teachers (Schoen, et. al 2003).

Discussions of Similar Studies on the Impact of Standardized-Based Testing on Disadvantaged Students

Policymakers and school reformers agree that the achievement gap based on race/ethnicity and class must close if the United States is to preserve its economic influence (Yaffe, 2009). Yafee (2009) noted that NCLB greatest contribution was in highlighting the achievements of subgroups that had low performance. The author stated that the attention brought about additional assistance to disadvantaged students who were struggling in their academics. It challenged the school systems to provide academics opportunity to all students, regardless of backgrounds (Yaffe, 2009). A program implemented by Educational Testing Service (ETS) provided the middle schools of Portland, Maine an assessment to document students' learning, assist teachers to improve their teaching practices, and to provide a

المنارة للاستشارات
www.manaraa.com

valuable educational experience. This assessment called the Center for the Study of Teacher Assessment (CBAL) tests the cognitive levels of students in reading by using it in meaningful tasks (Yaffe, 2009). Since this improved assessment program is still underway, conclusions on the program are still pending.

Another program implemented by the researchers at the University of California, called The Study of Promising Afterschool Programs examines the relationship between quality afterschool programs and desired academic and behavioral outcomes for disadvantaged students. These programs were supervised by trained staff. The two-year study concerns students from low-income, diverse backgrounds from elementary and middle schools from eight states in urban, rural, and metropolitan centers (Vandell, Reisner, & Pierce, 2007). The researchers concluded that there were positive outcomes for students who attended regularly in the afterschool programs. Students in elementary and middle schools test scores improved significantly, compared to their peers who were unsupervised during after-school hours. Students' work habits also improved significantly. Students in elementary schools social skills with peers improved where aggressive behaviors were reduced. Students in middle schools show a reduction in the consumption of alcohol and drugs while in the after-school programs (Vandell, et. al, 2007).

Discussion of Social Factors and Attitudes that Hinder Educators from Teaching Reform Methods to Disadvantaged Students

It is predicted that when students have behavioral problems during childhood and adolescence, they will experience academic failure (Zimmerman, Khoury, Vega, Gil, & Warheit, 1995). Student achievement maybe influenced by cultural and social differences between the teacher and the student. Researchers have found that teachers' expectations of disadvantaged students' achievement level are lower and may receive poor instruction in the classroom (Ladson-Billings, 1994; Zimmerman, et al., 1995). Students are keenly aware of

المنارة للاستشارات
www.manaraa.com

deferential treatment and may affect their self-image and motivation for learning. Thompson, Warren, and Carter (2004) investigated high school teachers who have attitudes and beliefs that might have a negative effect on their teaching practices, student achievement, and parental involvement. It was found that teachers had low expectations of students from low SES background and high expectations of students from high SES backgrounds. Because of the deferential treatment from teachers, students had low expectations of teachers and eventually withdrew from learning. They were often hostile toward students who experienced high expectations from teachers (Thompson & et al., 2004). Teachers were given a survey and there were contradictions in statements that were given by teachers. Teachers claimed that they made the curriculum relevant to students' lives, but they later admitted that their students did not work collaboratively. Another contradiction was that they treated their students differently than how they would treat their own children. They believed that their students deserve less. The NCLB mandate puts additional pressure on teachers to close the achievement gap by improving students' standardized test scores (U.S. Department of Education, 2002). Emphasis has been placed on achievement but little contemplation of the impact of teachers' beliefs about their students' ability to do well on standardized assessments (Thompson, e. al. 2004). In conclusion, Thompson et al. ((2004) stated that teachers are the most important factor for affecting student achievement and professional development designed to strengthen instructional practices and change teachers' negative beliefs will improve student achievement.

Discussions on Student Achievement

In response to the NCLB Act, the HSCE was implemented in Michigan in 2006. It is a guideline that is intended to promote academic achievement. This achievement is predicated on the MME. Researchers pointed out that gender, class, and ethnicity/race plays a part in student achievement (Campbell, 2000; Hoy, Tarter, & Hoy, 2006; Lubienski, 2000, 2002;

المنارة للاستشارات
www.manaraa.com

McGraw, Lubienski, & Strutchens, 2006; Pearce, 2006; Stinson, 2006). Some researchers state that teacher effectiveness and preparation play an important role in academic achievement (Ladson-Billings, 1994; Reeves, 2003). Other researchers state that all students, regardless of economic background and social issues, should be active participants in their learning (Knapp, Shields, & Turnbull, 1995; Lubienski, 2000; Stinson, 2006). This study highlighted all three viewpoints, but demonstrated empirically that the force behind student achievement is the effectiveness and preparation of culturally relevant teachers through standards based teaching. Figure 1 demonstrates that effective teachers is the dominate force behind student achievement.

Chapter Summary

This chapter provided an informational foundation for the potential impact of standards based curricula on student performance. Education reformers have a new idea for school reform: high, public standards intended for all students. Most states have their version of high standards of education. After these standards were in place, 4th and 8th grade minority students began to excel but not fast as their white counterparts. It was found that elementary minority students were at least two years behind other students and even further behind in years when they reach high school.

There is the belief from some teachers and educators that “at risk” students are unable to master complex problem solving. They are only able to do simple computational problems with constant directions from teachers. Even though NAEP has reported that there is growth with economically deprived students, their scores are below the national average in mathematics. This may derive from the critiques of conventional teaching where teachers believe that minority students are incapable of learning high-level mathematically-challenging problem-solving. Hence, they should be deprived of more meaningful, challenging work.

المنارة للاستشارات
www.manaraa.com

HSCE is a description of what students should know and be able to do in English Language Arts (ELA) and mathematics in preparation for successful post-secondary engagement. It challenges students to master the concepts embedded in mathematics. HSCE give students the ability to apply knowledge, to analyze, and propose solutions to real-world problems. It was written and developed to be in alignment with the NCTM standards. It was introduced to educators so that they may facilitate learning and assist students with discovery and investigations as it related to real-world experiences. However, Berry (2003) stated that teachers' methodology is one of the factors that contribute to poor performance on tests in mathematics. He also stated that there is a correlation between teacher effectiveness and students' mathematical achievement. McKinney and Frazier (2008) noted that teachers are teaching the same way as they were taught in school. The researcher proposes that there are other learning styles and methods that could be used to teach students, such as CPMP (Huntley et al., 2000; Schoen et al., 2003).

المنارة للاستشارات
www.manaraa.com

CHAPTER 3

METHODOLOGY

Introduction

The methodology chapter describes how the study was accomplished. The chapter commences with the research design, which is described fully then continues to details of the setting for the study, target population, and sample selection. The data gathering procedures, including methods, instruments, and reliability and validity are described. The data analysis used to address the research questions is presented.

The researcher was interested in knowing if students who are taught using the Core-Plus Mathematics Project (CPMP) curriculum score higher on procedural and conceptual knowledge than students who are not taught using the CPMP curriculum. For 12 weeks, the researcher taught the two classes from the *Algebra I* textbook. However, the treatment group received the CPMP curriculum along with the *Algebra I* textbook, with the control class using the *Algebra I* textbook and the standard curriculum. The students took three examinations and one final examination. The researcher collected data from each examination. At the end of the 12 weeks, the researcher analyzed the data from each examination. Since the researcher wanted to know the students' learning experiences of the mathematical concepts that were taught during the 12 weeks, the researcher had students in the treatment and control group write their thoughts in a journal. They wrote in their journals approximately once a week for an average of 15 minutes. The journal entries were related to mathematical topics the researcher gave them. The researcher randomly sampled journal entries from each groups. The researcher wanted to know students' perceptions regarding the use of the CPMP methods. The researcher gave the treatment group a survey and a short answer response. The researcher wanted to know if there is a difference in procedural and conceptual knowledge between male and female students in the treatment and control groups.

المنارة للاستشارات
www.manaraa.com

Three units, (a) writing linear equations (b) solving and graphing linear inequalities, and (c) systems of linear equations and inequalities, in the *Algebra I*, McDougal Littell textbook that was used in the study. These three units were integrated with Course I of the Core-Plus Mathematics Project (CPMP). This investigation sought to determine if the use of the CPMP as a standard based curriculum demonstrated an increase in 9th grade students' performance in procedural and conceptual problems in each of the three units of Algebra.

The following research questions are addressed in this study:

1. Do students who are taught the CPMP curriculum score higher on procedural knowledge than students who are not taught the CPMP curriculum?
2. Do students who are taught the CPMP curriculum score higher on conceptual knowledge than students who are not taught the CPMP curriculum?
3. What are perceptions of students in the treatment group regarding the use of the CPMP methods?
4. Is there a difference in procedural and conceptual knowledge between male and female students in the treatment and control groups?

Research Design

A quasi-experimental, descriptive research design was used for this study. The researcher collected data simultaneously from both the treatment and control groups to address the research questions. The quasi-experimental design is a nonequivalent (pretest and posttest) control-group design. Quasi-experimental design was chosen because the students in the two classes were not randomly assigned to the treatment and control groups. The two groups were similar based on previous test scores, abilities, and backgrounds. To control specific carryover from the CPMP curriculum to the traditional curriculum, the control group was taught earlier in the day than the treatment group during the same 12-week period. The researcher taught both groups in the same classroom. The researcher collected all data from

المنارة للاستشارات
www.manaraa.com

the three examinations and the final examination. Each exam was scored using a rubric to maintain objectivity by the researcher. The researcher presented two types of instruction for *Algebra I* course: (a) the treatment group received instruction that was derived from the *Algebra 1* textbook along with the CPMP curriculum and (b) the control group was instructed only from *Algebra I* textbook. The *Algebra I* textbook is provided by the school district and the CPMP materials were provided by the researcher.

The study used a static-group pretest-posttest comparison design. In this design the two groups experienced different methods of teaching based on the textbooks that were used. Both groups were given the same pretest to determine if the participants in the groups differed on mathematical ability prior to starting the experiment. If statistically significant differences were found on the pretest, the scores on this measure were used as the covariate in subsequent analyses.

Variables

Independent Variables

The independent variables for this study are the type of curriculum and gender of the students. Two types of instruction were used in this study, using the *Algebra I* textbook and using Unit 1 and 3 in the CPMP textbook in conjunction with the *Algebra I* textbook. To minimize problems with extraneous variables, the researcher taught both the treatment group and control group.

Dependent Variables

The dependent variables will be the test scores from: (a) examination one, (b) examination two, (c) examination three, (d) the final examination, and (e) perceptions of the instructional method (treatment group only. Each of the examinations and final examination had sections that tested procedural knowledge and conceptual knowledge separately. The examination and final examination were scores using a rubric to ensure consistency among the

المنارة للاستشارات
www.manaraa.com

grades. The first examination will included the topic called writing linear equations. The second examination included the topic called solving and graphing linear inequalities. The third examination included the topic called the systems of linear equations and inequalities. The final examination was the accumulation of the three units. Table 1 presents the examinations that will be used as data in this study.

Table 1

Procedural and Conceptual Examinations

Procedural Knowledge	Conceptual Knowledge
Examination One	Examination One
Examination Two	Examination Two
Examination Three	Examination Three
Final Examination	Final Examination

Population and Sampling

The study took place in an urban public high school in a large urban district of Wayne County in the Southeastern region of Michigan. Wayne County's median household income is $49,182. Wayne County has a population of 2,061,162 with 3.8% Latino, 49.4% White, 41.4 African American, and 1.7% Asian. The large urban community has a population of 871,000 with 5% Latino, 10.5% White, 81.6% African American, and 1.7% other. The median household income is $35,611 and families represent 64.9% of the population. Thirty-seven high schools in the urban school district and these schools are among approximately 615 schools in Michigan that have been utilizing the HSCE objectives. Each of the schools began implementing the GLCE and HSCE in the fall of 2006. Each high school teacher in each of these buildings was trained on the GLCE and HSCE. The targeted population is 9th grade students in the school district. The accessible population is 9th grade students in a single urban

المنارة للاستشارات
www.manaraa.com

public high school. The non-random sampling is taken from two classes (60 students) of 9th grade students in the same urban public high school. The urban public high school has an average enrollment of 1031 students per year, where 30% are 9th grade, 23.6% are 10th grade, 23.7% are 11th grade, and 23% are 12th grade. Average daily attendance for students is 97%. The staff is 100 percent highly qualified in core academic subjects. Counselors of the schools selected students to be in the two classes based on scheduling preferences and the availability of teachers.

Data Gathering Methods

The researcher conducted the study by using the following instruments: a pre-test, three unit examinations, a final examination, a demographics survey, treatment group's survey, and journal entries from the treatment and control groups. Data was collected from each of these items and analyzed. The *Algebra I* textbook was used for the treatment group as well as the control group. The treatment group also used the CPMP curriculum. Supplemental resources were used in each group. Each group had approximately the same pacing for the course. Both groups followed the same standards that were described in the HSCE curriculum. Both groups used graphing calculators while in the course. HSCE strongly encourages technology and calculator usage in the classrooms. Teaching each of the three units included in this study took approximately three weeks. A 55-minute examination followed each unit. Students reviewed all information from the previous three examinations and completed the final examination. The final examination took approximately 75-minutes. It took approximately 12 weeks to teach the units and complete the examinations. Throughout the study, the researcher gave the treatment and control group topics to journal their ideas. The students wrote in their journals for approximately 15-minutes, once a week, for about nine weeks. A sample of the journal entries was randomly taken from the two groups. These samples were used to draw conclusions about the learning experiences of the students. The

المنارة للاستشارات
www.manaraa.com

researcher conducted a student survey on the use of three units of the *Algebra I* textbook that is embedded with the CPMP materials.

Instruments

The instruments that were used for data purposes are: a pre-test, three unit examinations (with procedural and conceptual sections), the final examination (with procedural and conceptual sections), demographics survey, and the treatment group's survey. The *Algebra I* textbook and CPMP materials were used as a treatment to teach the treatment group for all three units in *Algebra I*, while the *Algebra I* textbook was used to teach the control group.

Pretest

The pretest was designed by the urban school district's mathematics department. The researcher administered the pretest and collected the scores. The answers for the pretest were obtained from the mathematics department to ensure reliability of the sample. During the first week of the semester, the researcher gave two groups of 9th grade students a pretest. The pretest was a series of problems that students were predisposed to in the 8th grade. It was used to establish if the pre-treatment was equal. The pretest determined whether students in the treatment and control groups were similar in their mathematical ability. It was used as a covariate in analyzing the results. The analysis of covariance was used to reduce experimental error. The pretest correlated with the dependents (three exams, the final exam, and perceptions of the treatment group).

Examinations

The three unit examinations and the final examination were designed for this study. The three unit examinations measured students' procedural knowledge of mathematical concepts and their conceptual knowledge to model and solve real-life problems. The final examination measured the students' overall procedural and conceptual knowledge and

المنارة للاستشارات
www.manaraa.com

achievement of the *Algebra I* course. Each of the examinations and the final examination included a rubric to measure scoring. Each examination was in accordance to the HSCE objectives. Chapter 5: Writing Linear Equations was in conjunction to:

- L1.2.4: Organize and summarize a data set in a table, plot, chart, or spreadsheet; find patterns in a display of data; understand and critique data displays in the media.
- A1.2.1: Write equations and inequalities with one or two variables to represent mathematical or applied situations, and solve.
- A2.4.1: Write the symbolic forms of linear functions (standard [i.e. $Ax + By = C$, where $B \neq 0$], point-slope, and slope-intercept) given appropriate information, and convert between forms.
- A2.4.3: Relate the coefficients in a linear function to the slope and *x*- and *y*-intercepts of its graph (HSCE, 2006, pp. 6, 8, 10).

Chapter 6: Solving and Graphing Linear Inequalities was in conjunction to:

- L1.2.4: Organize and summarize a data set in a table, plot, chart, or spreadsheet; find patterns in a display of data; understand and critique data displays in the media.
- A1.2.1: Write equations and inequalities with one or two variables to represent mathematical or applied situations, and solve.
- A1.2.4: Solve absolute value equations and inequalities, (e.g. solve $|x - 3| \leq 6$), and justify steps in the solution.
- A2.1.3: Represent functions in symbols, graphs, tables, diagrams, or words, and translate among representations (HSCE, 2006, 6, 8, 9).

Chapter 7: Systems of Linear Equations and Inequalities was in conjunction to:

المنارة للاستشارات
www.manaraa.com

- A1.2.1: Write equations and inequalities with one or two variables to represent mathematical or applied situations, and solve.
- A2.4.2: Graph lines (including those of the form $x = h$ and $y = k$) given appropriate information (HSCE, 2006, 8, 10).

Demographic Survey

Both the treatment and control groups did a demographic survey on the first day of the study. The reason for this survey was to obtain the demographic information of the subjects and to insure a representation of the sample population. It was also to examine the differences in procedural and conceptual knowledge between male and female students in the treatment and control groups.

Student Survey

The students from the treatment group completed a survey regarding their feelings on the use of the *Algebra I* textbook and the Core-Plus materials. This survey used a 5-point Likert-scale and was conducted at the completion of the three units in the *Algebra I* course. The student survey included open-ended statements as well as closed-end statements.

Instrument Validity

Validity depended on evidence that was content-related. The researcher wanted to measure students who were using procedural knowledge with the CPMP curriculum verses students who were using procedural knowledge without using the CPMP curriculum. For unit one, writing linear equations, as evidence that students were using procedural knowledge with the CPMP curriculum verses students that were using procedural knowledge without using the CPMP curriculum, they should be able to:

1. L1.2.4: Organize and summarize a data set in a table, plot, chart, or spreadsheet; find patterns in a display of data; understand and critique data displays in the media.

المنارة للاستشارات
www.manaraa.com

2. A1.2.1: Write equations and inequalities with one or two variables to represent mathematical or applied situations, and solve.
3. A2.4.1: Write the symbolic forms of linear functions (standard [i.e. $Ax + By = C$, where $B \neq 0$], point-slope, and slope-intercept) given appropriate information, and convert between forms.
4. A2.4.3: Relate the coefficients in a linear function to the slope and *x*- and *y*-intercepts of its graph (HSCE, 2006, pp. 6, 8, 10).

For unit two, solving and graphing linear inequalities, as evidence that students were using procedural knowledge with the CPMP curriculum verses students that were using procedural knowledge without using the CPMP curriculum, they should be able to:

1. L1.2.4: Organize and summarize a data set in a table, plot, chart, or spreadsheet; find patterns in a display of data; understand and critique data displays in the media.
2. A1.2.1: Write equations and inequalities with one or two variables to represent mathematical or applied situations, and solve.
3. A1.2.4: Solve absolute value equations and inequalities, (e.g. solve $|x - 3| \leq 6$), and justify steps in the solution.
4. A2.1.3: Represent functions in symbols, graphs, tables, diagrams, or words, and translate among representations (HSCE, 2006, pp. 6, 8, 9).

For unit three, systems of linear equations and inequalities, as evidence that students were using procedural knowledge with the CPMP curriculum verses students that were using procedural knowledge without the CPMP curriculum, they should be able to:

1. A1.2.1: Write equations and inequalities with one or two variables to represent mathematical or applied situations, and solve.

المنارة للاستشارات
www.manaraa.com

2. A2.4.2: Graph lines (including those of the form $x = h$ and $y = k$) given appropriate information (HSCE, 2006, pp. 8, 10).

The researcher wanted to measure students who were using conceptual knowledge with CPMP curriculum verses students who were using conceptual knowledge without using CPMP curriculum. For unit one, writing linear equations, as evidence that students were using conceptual knowledge with the CPMP curriculum verses students that were using conceptual knowledge without using the CPMP curriculum, they should be able to:

1. L1.2.4: Organize and summarize a data set in a table, plot, chart, or spreadsheet; find patterns in a display of data; understand and critique data displays in the media.
2. A1.2.1: Write equations and inequalities with one or two variables to represent mathematical or applied situations, and solve.
3. A2.4.1: Write the symbolic forms of linear functions (standard [i.e. $Ax + By = C$, where $B \neq 0$], point-slope, and slope-intercept) given appropriate information, and convert between forms.
4. A2.4.3: Relate the coefficients in a linear function to the slope and x- and y-intercepts of its graph (HSCE, 2006, pp. 6, 8, 10).

For unit two, solving and graphing linear inequalities, as evidence that students were using conceptual knowledge with the CPMP curriculum verses students that were using conceptual knowledge without using the CPMP curriculum, they should be able to:

1. L1.2.4: Organize and summarize a data set in a table, plot, chart, or spreadsheet; find patterns in a display of data; understand and critique data displays in the media.
2. A1.2.1: Write equations and inequalities with one or two variables to represent mathematical or applied situations, and solve.

المنارة للاستشارات
www.manaraa.com

3. A1.2.4: Solve absolute value equations and inequalities, (e.g. solve $|x - 3| \leq 6$), and justify steps in the solution.
4. A2.1.3: Represent functions in symbols, graphs, tables, diagrams, or words, and translate among representations (HSCE, 2006, pp. 6, 8, 9).

For unit three, systems of linear equations and inequalities, as evidence that students were using conceptual knowledge with the CPMP curriculum verses students that were using conceptual knowledge without using the CPMP curriculum, they should be able to:

1. A1.2.1: Write equations and inequalities with one or two variables to represent mathematical or applied situations, and solve.
2. A2.4.2: Graph lines (including those of the form $x = h$ and $y = k$) given appropriate information (HSCE, 2006, pp. 8, 10).

As evidence of students' perceptions regarding the use of the CPMP methods, the researcher prepared a survey and open-ended, short answer questions that contained statements and questions for the students to answer. Their answers constituted the evidence that the researcher sought. Two experts reviewed the content and format of the instruments and judged whether or not the instruments are valid. One expert was from the Division of Theoretical and Behavioral Foundations Educational Evaluation and Research at Wayne State University, Detroit, MI. The other expert was from the Mathematics Education Department at Wayne State University, Detroit, MI.

Data Analysis

Scales of measurement

The three examinations and the final examination included a rubric that outlined how the examinations were scored on a scale of zero to 100. The interval scaling on the examinations provided support that parametric inferential statistical analyses could be used to answer the research questions. A 100 meant that all expectations had been met, whereas a zero

المنارة للاستشارات
www.manaraa.com

meant that none of the expectations had been met. A Likert-type scale ranging from 0 for not at all to 4 for very well was used for students' perception on the use of CPMP.

Input data format.

Multivariate analysis of covariance (MANCOVA) was used in this study. The eight dependent variables in this analysis are procedural and conceptual knowledge for three examinations and the final examination, as well as perceptions of the treatment group regarding the instructional methods. The independent variables are group membership (CPMP or traditional) and gender of the students. The pretest scores were used as the covariate in these analyses.

Appropriate Statistical Tests

To determine if students who were taught using the CPMP curriculum score higher on procedural and conceptual knowledge than students who were not taught using the CPMP curriculum, a statistical test was performed on the differences between the mean scores of the examinations for each group. For the hypotheses tested for a multivariate case, the researcher had two variates, one for the dependent variables, and another for the independent variable. To measure statistical measures, Pillai's criterion (multivariate F) was used for testing overall significance between groups in a multivariate situation. "Pillai's criterion is considered more robust and should be used if sample size decreases, unequal cell appear, or homogeneity of covariances is violated . . . [also] It is the preferred measure when the basic design considerations (adequate sample size, no violations of assumptions, approximately equal cell sizes) are met (Hair, Black, Babin, Anderson, & Tatham, p.414).

Underlying assumptions addressed.

The assumptions for a MANCOVA design are (a) the observations of each of the groups are independent, (b) variance/covariance matrices must be equal (or comparable for all treatment groups, (c) the dependent variables must have a multivariate normal distribution, (d)

المنارة للاستشارات
www.manaraa.com

there are linearity and multicollinearity of dependent variables, and (e) there is sensitivity to outliers (Hair et. al., pp 399-411).

Nominal alpha selected and rationale.

Setting the alpha level at .05, was denoted statistical significance, the researcher balanced the desire to be strict in a significant difference between groups while still not setting the criterion so high that differences cannot be found.

Description of computation method

Predictive Analytics Software (PASW) ver. 17.0 (formerly SPSS Statistics) its leading statistics software suite used by commercial, government, and academic organizations to solve business and research problems. This software was used to analyze the data to address the research questions.

Quantitative and Qualitative Summary

This study was designed to answer significant questions related to the CPMP curriculum and student achievement. The study explored the three units of *Algebra I.* The three units were: (a) writing linear equations, (b) solving and graphing linear inequalities, and (c) systems of linear equations and inequalities. The treatment group had the use of CPMP curriculum along with the *Algebra I* textbook. The control group had only the use of the *Algebra I* textbook. Research questions and hypotheses were stated. The instruments that were used were the pretest, the three unit examinations, the final examination, the treatment and control groups' journal entries, demographic survey, and a treatment groups' survey. The pretest, the three unit examinations, the final examination, and gender of the demographic survey were used in a MANCOVA. The treatment groups' survey was rated using a Likert scale.. Once a week, students wrote in their journals about their learning experiences. The researcher chose a topic pertaining to the lesson and had students' journal their learning experiences. The students were the treatment and control groups. They wrote journal entries

المنارة للاستشارات
www.manaraa.com

that the researcher randomly chose from each group to provide additional support for the conclusions in Chapter IV.

المنارة للاستشارات
www.manaraa.com

CHAPTER IV

RESULTS OF DATA ANALYSIS

This chapter presents the results of the data analysis used to describe the sample and address the four research questions developed for this study. The chapter is divided into three sections. The first section provides a description of the sample and the second section provides baseline data on the dependent variables. The results of the inferential statistical analyses used to address the research questions are presented in the third section of the chapter.

The purpose of the proposed study is to see if the effective use of the CPMP as a standards based curriculum results in an increase in 9th grade students' mathematics achievement. The school district requires every high school to use the same textbook, which is the *Algebra I*, McDougall-Littell. For the purposes of the study, the *Contemporary Mathematics in Context: A Unified Approach* (Core-Plus Mathematics Project, CPMP) textbook will be used in addition to the *Algebra I*, McDougall-Littell. Specifically, the CPMP course Unit 1 and 3, "Linear Models," was incorporated with *Algebra I*, McDougall Littell. These two textbooks were used simultaneously with the treatment group to demonstrate standards based teaching methods. Only *Algebra I*, McDougall-Littell was used with the control group to demonstrate a more traditional-based teaching.

Description of the Sample

The research selected two sections of Algebra 1 students at a single high school in a large urban area. Twenty-eight students in one class were assigned to the control group and 32 students in the second class were included in the treatment group. The students were asked to provide their citizenship, race, and gender on a short demographic survey.

All of the students were in the ninth grade and were United States citizens. The gender of the students was crosstabulated by their group membership for presentation in Table 2.

المنارة للاستشارات
www.manaraa.com

Table 2

Crosstabulation- Gender of Students

	Group Membership					
	Control		Treatment		Total	
Gender	Number	Percent	Number	Percent	Number	Percent
Male	11	39.3	14	43.8	25	41.7
Female	17	60.7	18	56.3	35	58.3
Total	28	100.0	32	100.0	60	100.0

Of the 25 male students in the study, 11 (39.3%) were assigned to the control group classroom and 14 (43.8%) were assigned to the treatment group classroom. Seventeen (60.7%) girls were in the control group and 18 (56.3%) were in the treatment group.

The students all indicated they are United States citizens. The students also were asked to provide their race/ethnicity on the survey. Their responses were summarized using crosstabulations. Table 3 presents results of this analysis.

Table 3

Crosstabulation- Race/Ethnicity of Students

	Group Membership					
	Control		Treatment		Total	
Race/Ethnicity	Number	Percent	Number	Percent	Number	Percent
African American	25	89.3	29	90.6	54	90.0
Other	3	10.7	3	9.4	6	10.0
Total	28	100.0	32	100.0	60	100.0

The majority of students in both the control group (n = 25, 89.3%) and the treatment group (n = 29, 90.6%) reported their race/ethnicity as African American. Three (10.7%) students in the control group and 3 (9.4%) in the treatment group indicated “other” as their

المنارة للاستشارات
www.manaraa.com

race/ethnicity. These students were multiethnic, with African American/White or African American/American Indian reported as their race/ethnicity.

Pretest Comparisons

Prior to beginning the treatment, students in both classes completed a pretest algebra test developed by the math department of the urban school district to provide evidence that the two groups were statistically equivalent at the start of the experiment. The pretest was a school district developed test to measure algebraic concepts. The scores on the tests were compared using t-tests for two independent samples. Results of this analysis are presented in Table 4.

Table 4

t-Test for Two Independent Samples – Pretest Scores by Group Membership

Group	Number	Mean	SD	DF	t-Value	Sig
Control	28	77.36	11.29	58	-.96	.339
Treatment	32	77.91	9.18			

The results of the comparison of the pretest scores for the control and treatment groups were not statistically significant, t (58) = -.96, p = .339. This finding indicated that students in the control group (m = 77.36, sd = 11.29) and the treatment group (m = 77.91, sd = 9.18) were not substantially different before beginning the treatment.

The pretest scores were compared by gender to determine if the students differed on the pretest by gender. The results of the t-test for two independent samples are presented in Table 5.

المنارة للاستشارات
www.manaraa.com

Table 5

t-Test for Two Independent Samples – Pretest Scores by Gender

Group	Number	Mean	SD	DF	t-Value	Sig
Male	25	81.68	8.10	58	1.95	.057
Female	35	76.60	11.11			

The results of the t-test for two independent samples used to compare the pretest scores by gender was not statistically significant, t (58) = 1.95, p = .057. While the male students (m = 81.68, sd = 8.10) had higher mean scores on the pretest than the female students (m = 76.60, sd = 11.11), the difference was not substantial enough to be considered significantly different.

Although the differences by group and by gender did not provide evidence of statistically significant differences, the pretest scores were used as covariates in subsequent analyses used to address the research questions.

Research Questions

Four research questions were developed for this study. Each of the questions was addressed using inferential statistical analyses. All decisions on the statistical significance of the findings were made using a significance level of .05.

Research question 1: Do students who are taught the CPMP curriculum score higher on procedural knowledge than students who are not taught the CPMP curriculum?

A one-way multivariate analysis of covariance (MANCOVA) was used to determine if students in the treatment group scores higher on procedural knowledge than students in the control group. The scores for Exam 5, Exam 6, Exam 7, and the Final Exam were used as the dependent variables, with group membership used as the independent variables. The pretest scores were used as the covariate in this analysis. The results of the MANOVA are presented in Table 6.

المنارة للاستشارات
www.manaraa.com

Table 6

One-way Multivariate Analysis of Covariance – Procedural Knowledge by Group Membership

	Pillai's Trace	F Ratio	DF	Sig	Effect Size
Covariate	.29	5.57	4, 54	.001	.29
Group	.11	1.67	4, 54	.171	.11

The Pillai's trace of .11 obtained on the one-way MANCOVA comparing procedural knowledge between students in the control group and those in the treatment group was not statistically significant, F (4, 54) = 1.67, p = .171, d = .11. This result indicated that students in both the treatment and control groups did not differ in procedural knowledge. To examine the lack of statistically significant differences, descriptive statistics were obtained for each of the four exam scores. A significant adjustment in the exam scores had been made by the pretest scores. Table 7 presents results of this analysis.

Table 7

Descriptive Statistics – Adjusted Procedural Scores by Group Membership

	Group Membership			
	Control (n = 28)		Treatment (n = 32)	
Procedural Exams	Mean	SE	Mean	SE
Exam 5	80.62	3.19	75.77	2.98
Exam 6	70.64	4.86	58.26	4.54
Exam 7	43.98	5.33	40.67	4.99
Final Exam	58.76	3.97	59.84	3.71

Students in the control group had higher mean scores on procedural exam 5, exam 6, and exam 7 than students in the treatment group. In contrast, students in the treatment group had higher scores on the Final Procedural Exam than the students in the control group. However, these differences were not substantial enough to be considered statistically

المنارة للاستشارات
www.manaraa.com

significant. Based on the lack of statistically significant differences, it appears that students in the two groups had similar abilities in regard to procedural mathematics.

Research question 2: Do students who are taught the CPMP curriculum score higher on conceptual knowledge than students who are not taught the CPMP curriculum?

The scores for the conceptual exams (5, 6, 7, and final) were used as dependent variables in a one-way MANOVA. Group membership was used as the dependent variable in this analysis. Table 8 presents results of the MANCOVA.

Table 8

One-way Multivariate Analysis of Covariance – Conceptual Knowledge by Group Membership

	Pillai's Trace	F Ratio	DF	Sig	Effect Size
Covariate	.21	3.62	4, 54	.011	.21
Group	.60	19.97	4, 54	<.001	.60

The results of the one-way MANOVA used to compare the mean scores for the four exams by group membership were statistically significant, $F(4, 54) = 19.97$, $p < .001$, $d = .60$. The associated effect size of .60 was considered large, providing evidence that the results of this analysis had both statistical and practical significance. The results of the analysis for the covariate were statistically significant, $F(4, 54) = 3.62$, $p = .011$. This result indicated that the pretest was making statistically significant adjustments to the posttest mean scores for the conceptual exams. To determine which of the exams were contributing to the statistically significant result, the between-subject effects were examined. Table 9 presents results of this analysis.

المنارة للاستشارات
www.manaraa.com

Table 9

Between-Subjects Effects – Conceptual Knowledge by Group Membership

Source	Sum of Squares	DF	Mean Square	F Ratio	Sig	Effect Size
Exam 5	8973.93	1,57	8973.93	15.20	<.001	.21
Exam 6	18515.06	1, 57	18515.06	40.10	<.001	.41
Exam 7	39982.77	1, 57	39982.77	47.73	<.001	.46
Final Exam	1807.98	1, 57	1807.98	1.36	.209	.02

Three of the co conceptual exams differed by group membership. The results of the comparison for exam 5 between the treatment and control groups were statistically significant, $F(1, 57) = 15.20$, $p < .001$, $d = .21$. The effect size of .21 obtained on this analysis provided support that the differences on Exam 5 had both statistical and practical significance.

The comparison between the treatment and control group for exam 6 was statistically significant, $F(1, 57) = 40.10$, $p < .001$, $d = .41$. The large effect size obtained for this comparison indicated that the difference between the two groups on Exam 6 had both statistical and practical significance.

The results of the third exam (Exam 7) were statistically significant, $F(1, 57) = 47.73$, $p < .001$, $d = .46$. The associated effect size of .46 on this analysis provided support that the results of this analysis had practical, as well as statistical significance.

The comparison of the conceptual final exam between the two groups was not statistically significant, $F(1, 57) = 1.36$, $p = .209$, $d = .02$. This result indicated that students in the two groups did not differ on the final conceptual exam.

To further examine the direction of the statistically significant differences on the four conceptual exams, descriptive statistics were obtained for the two groups. Table 10 presents results of these analyses.

المنارة للاستشارات
www.manaraa.com

Table 10

Descriptive Statistics – Adjusted Conceptual Scores by Group Membership

	Group Membership			
	Control (n = 28)		Treatment (n = 32)	
Conceptual Exams	Mean	SE	Mean	SE
Exam 5	41.21	4.61	65.92	4.31
Exam 6	39.05	4.08	74.55	3.81
Exam 7	19.77	5.49	71.92	5.14
Final Exam	31.42	6.91	42.51	6.46

The adjusted mean scores were examined for the three conceptual exams (5, 6, and 7). The results of this examination provided support that the treatment group had higher adjusted mean scores than the control group for each of the exams. While the final exam did not differ significantly between the two groups, the students in the treatment group had higher mean scores than the control group. Based on these findings, it appears that students in the treatment group had better conceptual knowledge than students in the control group.

Research question 3: What are perceptions of students in the treatment group regarding the use of the CPMP methods?

The students in the treatment group completed a nine-item survey to measure their perceptions of the CPMP method of mathematics instruction. The students' responses were on a 0 to 4 scale ranging from not at all to very well. Table 11 presents the results of the t-test for one sample that compared the mean score on each survey question with 2, the midpoint of the 5-point scale. Scores that were significantly higher than 2 provided support that the students' perceptions on that item were positive, while scores significantly below 2 were indicative of negative perceptions of the item.

المنارة للاستشارات
www.manaraa.com

Table 11

t-Test for One Sample – Perceptions of CPMP Mathematics Instruction (Treatment Group Only)

Item	Number	Mean	SD	DF	t-Value	Sig
1. Using the *Algebra I* textbook and Core-Plus Materials were easy for me.	32	1.91	.96	31	-.55	.586
2. Using the Core-Plus materials helped me learn mathematics.	31	1.97	1.11	30	-.16	.873
3. I believe using the Core-Plus materials made mathematics tests easier.	31	1.39	1.20	30	-2.84	.008
4. I would like to have a program like CPMP to use for other subjects I study.	32	1.56	1.48	31	-1.67	.104
5. I believe Core-Plus can be taught to any student.	32	2.31	1.51	31	1.17	.251
6. I like using the CPMP method.	32	1.44	1.16	31	-2.74	.010
7. I will use my CPMP skills that I have acquired in class outside of school.	32	1.44	1.01	31	-3.14	.004
8. Members of my family are interested in knowing more about CPMP.	32	.81	1.00	31	-6.73	<.001
9. Using CPMP made learning mathematics more fun.	32	1.03	1.12	31	-4.89	<.001
Total Mean Score	32	1.54	.78	31	-3.32	.002

The students in the treatment group generally had negative perceptions regarding the CPMP mathematics instruction used in their Algebra I course. Five items on the survey and the total mean score were statistically significant in a negative direction. The first statistically significant item was “I believe using the Core-Plus materials made mathematics tests easier,” t (30) = -2.84, p = .008. The mean score of 1.39 (sd = 1.20) was significantly below the midpoint of 2.

The mean score of 1.44 (sd = 1.15) obtained on the comparison of the sixth item, “I like using the CPMP method” with the midpoint of 2 was statistically significant, t (31) = -2.74, p = .010. This finding provided evidence that the students in the treatment group had negative perceptions regarding the use of the CPMP method in their Algebra I class.

المنارة للاستشارات
www.manaraa.com

The comparison of the mean score of 1.44 (sd = 1.01) for the item, “I will use my CPMP skills that I have acquired in class outside of school” with the midpoint of 2 was statistically significant, t (31) = -3.14, p = .004. Based on this finding, it appears that students in the treatment group did not think that they would use the CPMP skills outside of school.

The mean score of .81 (sd = 1.00) for the item, “Members of my family are interested in knowing more about CPMP” was compared with the midpoint of 2, using t-tests for one sample. The results of this analysis was statistically significant, t (31) = -6.73, p < .001, providing support that students were not discussing the CPMP method using in their Algebra I course with their family.

The comparison of the mean score of 1.03 (sd = 1.12) for the item, “Using CPMP made learning mathematics more fun,” with the midpoint of 2 was statistically significant, t (31) = -4.89, sd = < .001. As a result of this analysis, the students in the treatment group did not perceive that using CPMP made learning mathematics more fun.

The total mean score for the nine items on the survey (m = 1.54, sd = .78) were compared to the midpoint of 2 using t-test for one sample. Results of this analysis were statistically significant, t (31) = -3.32, p = .002, indicating that in general students’ perceptions of the CPMP method used in their Algebra I class were negative.

Qualitative Questions Regarding CPMP. The treatment group also had eight open-response student survey questions. Question 1 asked, “What part of CPMP did you like”. Twenty seven students responded with portions of the CPMP they enjoyed. One student stated “I like the fact CPMP related to real situations”. Five students responded that they did not like it at all. Question 2, asked “What part of CPMP did you like the least.” Thirty students responded with portion of the CPMP they disliked. One student stated that “I least like how there were so many questions to one problem”. Another student stated that “some of the work was very tedious & time-consuming.” Question 3 asked, “What lesson in CPMP did you learn

المنارة للاستشارات
www.manaraa.com

the most." Some students stated that they learned graphing equations and inequalities the most. Others stated that they learned about the stem-and-leaf and box-and-whisker plot. Question 4 asked, "What lesson in CPMP did you learn the least." Two students indicated that they learned the least on systems of equations and tables and graphs. Ten students left this answer blank. Question 5 asked, "How often did you discuss CPMP with family members." Most students talked very little with family members. Other students left this question blank. Question 6 asked,"What was emphasized in the discussions." Eleven students discussed with family members either the CPMP curriculum or concepts related to the CPMP. Other students had very little conversations about the CPMP curriculum. Question 7 asked, "How often did you discuss CPMP with classmates outside of the class." Twenty students responded that they did discuss CPMP with classmates outside of the class. Twelve students never discussed CPMP with classmates outside of the class. Question 8 asked, "What was emphasized in the discussions." Twenty-two students responded by talking about the discussions as it relates to homework. One student stated in the discussions, "we didn't just go over answers, we discussed how & why we got them." Eleven students left question 8 blank.

Research question 4: Is there a difference in procedural and conceptual knowledge between male and female students in the treatment and control groups?

A 2 x 2 factorial multivariate analysis of covariance (MANCOVA) was used to determine if there were differences in procedural knowledge between male and female students in the control and treatment groups. The scores for the four exams (5, 6, 7, and the final) were used as the dependent variables. Gender and group membership were used as the independent variable, with the pretest scores used as the covariate. Table 12 presents results of this analysis.

المنارة للاستشارات
www.manaraa.com

Table 12

2 x 2 Factorial Multivariate Analysis of Covariance – Procedural Knowledge by Group Membership and Gender

Source	Pillai's Trace	F Ratio	DF	Sig	Effect Size
Covariate	.28	5.14	4, 52	<.001	.28
Group	.10	1.36	4. 52	.260	.10
Gender	.11	1.56	4, 52	.200	.10
Group x Gender	.05	.74	4, 52	.567	.05

The results of the 2 x 2 MANCOVA used to compare the two main effects, group and gender, for the four examination scores were not statistically significant. The interaction between group and gender also was not statistically significant. The covariate, pretest scores was statistically significant, $F (4, 52) = 5.14$, $p < .001$, $d = .28$, indicating the amount of adjustment in the examination scores was significant. To further examine the nonsignificant results, descriptive statistics were obtained for the two main effects and the interaction effect. Table 13 presents results of this analysis.

المنارة للاستشارات
www.manaraa.com

Table 13

Descriptive Statistics – Procedural Examination Scores by Group and Gender

Source	Number	Mean	SE
Group			
Procedural Exam 5			
Control	28	79.98	3.23
Treatment	32	75.16	2.99
Procedural Exam 6			
Control	28	70.50	5.03
Treatment	32	58.77	4.65
Procedural Exam 7			
Control	28	40.02	5.53
Treatment	32	40.25	5.11
Procedural Final Exam			
Control	28	58.49	3.97
Treatment	32	58.74	3.67
Gender			
Procedural Exam 5			
Male	25	73.76	3.42
Female	35	81.38	2.86
Procedural Exam 6			
Male	25	66.30	5.31
Female	35	62.97	4.45
Procedural Exam 7			
Male	25	40.58	5.84
Female	35	43.69	4.89
Procedural Final Exam			
Male	25	53.78	4.20
Female	35	63.45	3.51
Group x Gender			
Procedural Exam 5			
Control x Male	11	76.42	5.04
Control x Female	17	83.54	4.10
Treatment x Male	14	71.10	4.55
Treatment x Female	18	79.21	3.94
Procedural Exam 6			
Control x Male	11	70.16	7.83
Control x Female	17	70.84	6.38
Treatment x Male	14	62.43	7.08
Treatment x Female	18	55.11	6.13
Procedural Exam 7			
Control x Male	11	43.92	8.61
Control x Female	17	44.12	7.02
Treatment x Male	14	37.24	779
Treatment x Female	18	43.25	6.74
Procedural Final Exam			
Control x Male	11	56.41	6.19
Control x Female	17	60.56	5.04
Treatment x Male	14	51.14	5.59
Treatment x Female	18	66.33	4.84

المنارة للاستشارات
www.manaraa.com

The lack of significant differences among the two main effects, group and gender, and the interaction, group by gender, is supported by the lack of variability on the mean scores. Based on these findings it appears that students do not differ in terms of the procedures used in their Algebra I class.

The four conceptual examinations were used as the dependent variables in a 2 x 2 factorial MANCOVA. The pretest scores were used as the covariate, with group and gender used as the independent variables. Table 14 presents results of this analysis.

Table 14

2 x 2 Factorial Multivariate Analysis of Covariance – Conceptual Knowledge by Group Membership and Gender

Source	Pillai's Trace	F Ratio	DF	Sig	Effect Size
Covariate	.22	3.61	4, 52	.011	.22
Group	.60	19.85	4, 52	<.001	.60
Gender	.06	.87	4, 52	.487	.06
Group x Gender	.06	.79	4, 52	.540	.06

A statistically significant difference was found for the main effect of group, $F(4, 52) = 19.85$, $p < .001$, $d = .60$. This result was discussed in Research Question 2. The main effect of gender provided no evidence of a statistically significant difference in conceptual knowledge between male and female students, $F(4, 52) = .87$, $p = .487$, $d = .06$. The interaction effect between group and gender was not statistically significant, $F(4, 52) = .79$, $p = .540$, $d = .06$. The covariate was statistically significant, indicating the amount of adjustment in examination scores was substantial, $F(4, 52) = 3.61$, $p = .011$, $d = .22$. Table 15 presents the results of the descriptive statistics for the two main effects and the interaction effect.

المنارة للاستشارات
www.manaraa.com

Table 15

Descriptive Statistics – Conceptual Examination Scores by Group and Gender

Source	Number	Mean	SE
Group			
Conceptual Exam 5			
Control	28	40.29	4.75
Treatment	32	65.64	4.39
Conceptual Exam 6			
Control	28	38.17	4.20
Treatment	32	74.65	3.88
Conceptual Exam 7			
Control	28	18.97	5.69
Treatment	32	71.75	5.26
Conceptual Final Exam			
Control	28	30.65	6.94
Treatment	32	44.26	6.42
Gender			
Conceptual Exam 5			
Male	25	49.82	5.02
Female	35	56.11	4.20
Conceptual Exam 6			
Male	25	54.80	4.44
Female	35	58.02	3.71
Conceptual Exam 7			
Male	25	42.89	6.01
Female	35	47.83	5.03
Conceptual Final Exam			
Male	25	42.40	7.34
Female	35	32.50	6.14
Group x Gender			
Conceptual Exam 5			
Control x Male	11	35.56	7.40
Control x Female	17	45.01	6.03
Treatment x Male	14	64.08	6.69
Treatment x Female	18	67.20	5.79
Conceptual Exam 6			
Control x Male	11	33.88	6.54
Control x Female	17	42.46	5.33
Treatment x Male	14	75.72	5.91
Treatment x Female	18	73.58	5.12
Conceptual Exam 7			
Control x Male	11	14.94	8.86
Control x Female	17	23.01	7.22
Treatment x Male	14	70.85	8.01
Treatment x Female	18	72.65	6.93
Conceptual Final Exam			
Control x Male	11	27.99	10.82
Control x Female	17	33.30	8.81
Treatment x Male	14	56.81	9.78
Treatment x Female	18	31.70	8.46

المنارة للاستشارات
www.manaraa.com

The differences between the two groups on the three examinations and final examination provided support that students in the treatment group had significantly higher scores for each of the three examinations, but not for the final examination. However, when male and female students were compared, the differences were not statistically significant. The interaction between male and female students in the treatment and control groups showed that female students in both groups had higher scores than male students in their respective groups, but the differences were not substantial enough to be considered statistically significant.

Ancillary Findings

The researcher randomly chose 10 student journals from the control (n = 5) and treatment (n = 5) groups. The researcher assigned student numbers to each student. The students from the control group were student 1, student 2, student 3, student 4, and student 5. The students from the treatment group were student 6, student 7, student 8, student 9, and student 10. Students were asked to write based on the mathematical topics that the researcher gave them. Three questions were highlighted in this study. One question that was asked was "In real-life situations that can be modeled by a linear equation in slope-intercept form, what clues can you use to determine the equations?" Student 1 stated that "the slope tells you what happens over time". Student 4 stated that "an activity starts at the y-intercept, the slope is the increase or decrease over a period of time." Student 5 noted "the y-intercept tells you where you start the slope tells what happened over a period of time."Student 9 noted that you determine the equation by the "slope and y-intercept." Student 10 stated that "the population of a city or area can be modeled by a linear equation in slope-intercept form. The clues you can use to determine the equation is the population at a year, the increase per year, and years since the first." Each of the students comprehended the question and answered accordingly. But the response that student 9 gave, determined that the student did not understand the

المنارة للاستشارات
www.manaraa.com

question. Another question that was asked was “How do you know whether to shade above or below the boundary line when graphing an inequality?” Student 3 noted that “you choose a test point & if the solution of the inequality is true you shade on the side of the test point”. Student 4 noted that “you check the shading by plugging in a point on the graph.” Student 6 stated that you “use a test point. If the statement is true, shade that side. If not, the other.” Student 8 stated that “you know by first what the inequality states and also by using test points. Example: $x<5$, you know that know matter what, x is no more than 4 so you shade up because it’ll never be any of those numbers.” Students used key terms, such as, test points and shading. Although the answers were not articulated clearly, the students had a basic understanding of graphing inequalities. Student 8 used correct terminology, but the student did not understand that the equation $x= 5$, which is a vertical line. The shading for $x< 5$ would be shading to the left not shading up. The student must be thinking of $y>5$. The last question was “Describe in your own words how to solve a system of linear equations using substitution.” Student 2 stated that “the way to solve a system of linear equations is to solve one of the equations for one variable, substitute and solve for the other variable, substitute for revised equation, then check the solution.” Student 5 noted that “to solve a system of linear equations using substitution solve for y-intercept for y in the first equation. Substitut for y in the second equation solve for x then substitute x in the y-intercept. Solve for y.” Student 7 stated that “first write out the two equations. Then find which variable you are solving for in the first equation. Whichever variable you solve for in the first equation plug it in the 2nd equation. Then once you solve for that equation plug the second variable into first solution. Once you finish solving both equations you have your solution which is the intercept.” All students understood the substitution method when they described in detail how to solve a system of linear equations. Student 10 noted that “you can solve a linear equation using

المنارة للاستشارات
www.manaraa.com

substitution by getting one variable on side in one equation and then plugging it in, in the other problem.

a) $-x + y = 3$
$\underline{+x \quad +x}$
$Y = x + 3$

b) $4y + 5x = 20$
$4(x + 3) + 5x = 20$

$4x + 12 + 5x = 20$
$\underline{\quad -12 \qquad -12}$
$9x = 8$
$x = 8/9$

$Y = 8/9 + 3$
$Y = 3\ 8/9$

Student 10 described it in her own words and also wrote a problem and solved it by using substitution. In conclusion, the students had an average to above average comprehension of the mathematical topics that was given to them.

Summary

The results of the statistical analyses used to describe the sample and address the research questions were presented in this chapter. A discussion of the findings and recommendations for both practice and further research can be found in Chapter V.

المنارة للاستشارات
www.manaraa.com

CHAPTER V

DISCUSSION AND CONCLUSION

There was evidence that the use of the reformed based curriculum had a positive impact on students' learning mathematics (Goldsmith, Mark, & Kantrov, 1998). Many textbooks describe themselves as standards based, with textbooks looking totally different from textbooks of 15, or even 5 years ago. Most algebra textbooks include sections on problem solving and applied problems that involve practical uses for the mathematics the students were learning. They covered mathematical topics that were not covered 15 to 20 years ago. However, there was a significant difference between textbooks that have changed their practice problems to align themselves with the NCTM standards and the curricula that was designed to include the mathematical approaches and principles that were governed by the NCTM standards.

The purpose of the study was to examine if the effective use of the CPMP as a standards' based curriculum resulted in an increase in 9th grade students' mathematics achievement. The urban district requires every high school to use the same textbook, which is the *Algebra I*, McDougall-Littell. For the purposes of the study, the *Contemporary Mathematics in Context: A Unified Approach* (Core-Plus Mathematics Project, CPMP) textbook was used in addition to the *Algebra I*, McDougall-Littell. Specifically, the CPMP course Unit 1 and 3, "Patterns in Data" and "Linear Models," was incorporated with *Algebra I*, McDougall Littell. These two textbooks were used simultaneously with the treatment group to demonstrate standards based teaching methods. Only *Algebra I*, McDougall-Littell was used with the control group to demonstrate a more traditional-based teaching.

This study was designed to examine if students who were taught the Core-Plus Mathematics Project (CPMP) curriculum on procedural and conceptual knowledge scored higher than students who were not taught the CPMP curriculum. This study was designed to

المنارة للاستشارات
www.manaraa.com

learn about the treatment group's perceptions about learning CPMP curriculum. This study was also designed to examine if there was a difference in procedural and conceptual knowledge between male and female students in the treatment and control groups.

The *Algebra I* course was chosen for this study because topics related to equations do include a multiple representations approach so that students could receive a full understanding of the concepts. To be proficient in the use of linear models for problem solving, students must have a clear and connected understanding of the numeric, graphic, and symbolic representations of linear models and the ways that those representations can be applied to patterns in real data (Coxford, Fey, Hirsch, Schoen, Burrill, Hart, & Watkins, 1998).

The high school teachers in a large city in the Midwest are using newly-adopted High School Content of Expectations (HSCE, 2006), which included standards based objectives that are a guide for instruction. It was derived from the Grade Level Content Expectations (GLCE) as an extension for the high school curriculum, grades 9-12. GLCE was more specific and clarified what the students were expected to know and do on grade level assessments (Michigan Department of Education, 2009). The GLCE documents were the third tier of the Michigan Curriculum Framework that was directly correlated to the items on the grade level Michigan Educational Assessment Program (MEAP) assessment (Michigan Department of Education, 2009).

According to Huntley, Rasmussen, Villarubi, Sangtong, and Fey (2000), the CPMP was designed to provide rigorous, conceptually-rich instruction to students. The curriculum provides ways for students to explore and investigate mathematical topics that relate to real-life situations. The change in the design of curricula included emphasis on students being engaged in the exploration and investigation of mathematics where they work collaboratively to solve problems and assess their learning through different practices that are included in classroom activity (Harris, Marcus, McLaren, & Fey, 2001; Huntley et al., 2000; Malloy,

المنارة للاستشارات
www.manaraa.com

2003; Schoen, Cebulla, Finn, & Fi, 2003). The CPMP is a four-year integrated mathematics curriculum that builds on investigations of real-life contexts that lead to the discovery of mathematics in ways that make sense to students (Thompson & Senk, 2003). The mathematical lessons span 4 to 12 days and focus on interrelated mathematical concepts (Schoen et al., 2003). The students launch and explore in a small group investigation where they typically use tables, graphs, and graphing calculators. In collaborative situations, students were able to share responsibility and check their own understanding (Feathers, 1993). Then students shared and summarized their findings in full-class discussions (Harris et al. 2001; Schoen et al., 2003). They applied their findings and reflected on their conclusions. This exploration eventually can lead to deep mathematical knowledge and skills. CPMP should be used to teach procedural skills as well as conceptual understanding. Because teachers may be using the textbooks to teach traditional content in a traditional way, the effectiveness of HSCE has not been documented.

The researcher was interested in knowing if students who were taught using the CPMP curriculum scored higher on procedural and conceptual knowledge than students who were not taught using the CPMP curriculum. For 12 weeks, the researcher taught the two classes from the *Algebra I* textbook. However, the treatment group received the CPMP curriculum along with the *Algebra I* textbook, with the control class using the *Algebra I* textbook and the standard curriculum. The students took three examinations and one final examination. The researcher collected data from each examination. At the end of the 12 weeks, the researcher analyzed the data from each examination. Since the researcher wanted to know the students' learning experiences of the mathematical concepts that were taught during the 12 weeks, the researcher had students in the treatment and control group write their thoughts in a journal. They wrote in their journals approximately once a week for an average of 15 minutes. The journal entries were related to mathematical topics the researcher gave them. The researcher

المنارة للاستشارات
www.manaraa.com

randomly sampled journal entries from each group. The researcher wanted to know students' perceptions regarding the use of the CPMP methods. The researcher gave the treatment group a survey and a short answer response. The researcher also wanted to know if there is a difference in procedural and conceptual knowledge between male and female students in the treatment and control groups.

Three units, (a) writing linear equations (b) solving and graphing linear inequalities, and (c) systems of linear equations and inequalities, in the *Algebra I*, McDougal Littell textbook were used in the study. These three units were integrated with Course I of the Core-Plus Mathematics Project (CPMP). This investigation sought to determine if the use of the CPMP as a standard based curriculum demonstrated an increase in 9th grade students' performance in procedural and conceptual problems in each of the three units of Algebra.

Four research questions guided this study. Five sources of data, including both quantitative and qualitative, were utilized to address the research questions. The five sources included 1) the four examinations, 2) a nine question, 5-point Likert-type scale student survey, 3) eight open-response student survey questions, 4) demographic survey, and 5) students' journals. The evidence collected from these sources suggested that relationships exist between the students' scores and the use of the CPMP curriculum.

The Effectiveness of CPMP

The results of this study indicated that the CPMP did not impact the students' test scores on procedural knowledge. The control group had higher mean scores on procedural exam 5, exam 6, and exam 7. However, the treatment group had higher mean scores on procedural final examination. It was apparent that the control group and the treatment group learned similar procedural concepts from the two teaching methods. The treatment group did not gain significant procedural knowledge from the CPMP curriculum.

المنارة للاستشارات
www.manaraa.com

Based on the results of this study, students who were taught using the CPMP program had statistically significantly higher scores on conceptual knowledge for three of the four tests. The treatment group had statistically significantly higher mean scores on conceptual exam 5, exam 6, and exam 7, with the final exam not significantly different from the control group. A possible reason that the treatment group did not do well on the procedural as well conceptual portion of the final examination was because of a school disruption (a school-wide fire drill) that occurred during the examination period.

Students' Attitudes toward CPMP

Insight into the treatment group's attitudes about the CPMP curriculum was gained by a nine question, 5-point Likert-type scale student survey. The treatment group believed that CPMP can be taught to any student. Students somewhat thought that the *Algebra I* textbook and CPMP were easy for them. They also somewhat thought that using CPMP helped them learn mathematics. The treatment group had a negative perception on using CPMP that made mathematics tests easier. They had a negative perception on CPMP making learning mathematics more fun. They also had a negative perception on programs like CPMP being used for other subjects and would not use their CPMP skills outside of class. Finally, the treatment group had a negative perception on members of their families being interested in knowing more about CPMP.

The eight open response questions provided further evidence of student engagement while using the CPMP curriculum. Students stayed on task and actively participated in collaborative groups. They were able to be involved in the learning process even though there was not a sense of great enjoyment. Although there were limited conversations with family members about the CPMP, students were able to use the curriculum at home for homework and studying. The impact of students' attitudes toward any instructional program cannot be underestimated. It has already been highlighted that the treatment group had higher scores

المنارة للاستشارات
www.manaraa.com

than the control group on the conceptual exam 5, exam 6, exam 7 and final exam. However, their knowledge on learning the conceptual ideas from CPMP did not always match their enthusiasm. The students' lack of enthusiasm may be due to CPMP being introduced to them in the second semester of the year. During the first semester, they used the *Algebra I*, McDougall Littell textbook, which is a traditional-based textbook. In the second semester not only did the treatment group use the *Algebra I* textbook, they also used the CPMP textbook.

Gender Roles on Procedural and Conceptual Knowledge

According to researchers (Campbell, 1990; McGraw, Lubienski, & Strutchens, 2006) males generally have higher procedural mean scores than females. However, in this study, although females (control and treatment group combined) had a slightly higher procedural mean score on exam 5, exam 6 (control only), exam 7, and the final exam, the difference was not statistically significant. Although the females (control and treatment group combined) had a slightly higher conceptual mean score on exam 5, exam 6 (control only), exam 7, and the final exam (control only), the difference was not statistically significant. While these findings were unexpected and contrary to previous research, female students did not differ significantly from male students on either procedural or conceptual algebraic knowledge.

C*onclusions*

Based on the findings of this study, it is concluded that students who were taught the CPMP curriculum had similar scores on procedural knowledge to the students who were not taught the CPMP. The control group and the treatment group received instruction from the *Algebra I*, McDougall-Littell textbook. Although the treatment group received instruction from the CPMP curriculum, they received the majority of their procedural knowledge from the *Algebra I* textbook.

It is also concluded that students who were taught the CPMP curriculum scored higher on conceptual knowledge than students who were taught using the traditional curriculum. The

المنارة للاستشارات
www.manaraa.com

control group received instruction from only the *Algebra I* textbook, whereas, the treatment group received instruction from the *Algebra I* textbook and the CPMP curriculum. The *Algebra I* textbook had short application problems that resulted in solutions. The CPMP had application problems based on real-life situations that included multiple scenarios. These scenarios had many questions that allowed students to use multiple ways to solve them. When the CPMP curriculum was used with the traditional-based instruction, students' mathematics scores increased, regardless of students' gender.

It is concluded that there was no significant difference in procedural and conceptual knowledge between male and female students in the treatment and control groups. It is also concluded that although the females scored higher than the males on exam 5, exam 6, exam 7 and the final exam, there was no significant difference between the interactions of the groups and genders in procedural test scores. McGraw, Lubienski, & Strutchens (2006) have noted that in mathematics assessments, that although both male and female scores have increased, there is still a small gender gap favoring males. Campbell (1990) stated that the stereotype of mathematics being in the male domain, influences females mathematics achievement. Researchers do suggest that more studies should be done to analyze data for interactions among gender, race/ethnicity, and SES to determine if gender and race/ethnicity is an underlying factor (McGraw, et al., 2006).

Limitations of the Study and Recommendations for Future Practices

School Disruptions during the Final Exam. Just as the students started on their final exam, a school-wide fire drill began. All students were dismissed to a location outside of school and 20 minutes later were returned to the classrooms. After the fire drill, it is believed that the majority of the treatment group was no longer in the mental framework of completing the final exam. Although 20 minutes were lost due to the fire drill, an announcement was made that all students would receive an additional 10 minutes to complete the final. The

المنارة للاستشارات
www.manaraa.com

students continued with the final exam but were distracted when the students from other classes began to leave 10 minutes early. In the future, the school should eliminate having fire drills during final exams, as it disrupts the whole testing period. Also in the future, alternative dates should be included with earlier time slots, so if a disruption occurs, the final exam could be postponed to another date.

Limitations of the Study and Recommendations for Future Research

The following variables limited the results of this study. Future research should be used to address these limitations.

1. *Quasi-experimental research design*. The researcher was unable to randomly assign students to the treatment and control groups because of course scheduling restrictions. Because of the lack of random assignment, the groups could not be considered equivalent. To control for this threat to the internal validity of the design, the researcher pretested the students using a standardized test to determine any differences between the groups. No statistically significant differences were noted on the pretest scores. However, maturation of the students in the study may have been a threat to the internal validity of the design. The students had attended different middle schools and as a result entered the school with different background algebraic knowledge. However, the students had to pass an entrance examination to qualify to attend the magnet school for college bound students. While these students were generally the same age, grade, and ethnicity, they cannot be considered equivalent for the purpose of the research. The pretest scores were used as the covariate in all statistical analyses to remove differences in prior knowledge from the exam scores. Because using students in research is problematic in attempting to randomly assign students to treatment and control groups, future research could be done in two or more different schools with the

المنارة للاستشارات
www.manaraa.com

class used as the unit of analysis. The classes could then be randomly assigned to either the treatment or control group. Care should be taken to have only one class of students (assigned to either the treatment or control group) from each school included in the study.

2. *Number of students in the study*. This study was limited to only two classes in an urban school district. The researcher taught both classes. Future studies should include a larger number of schools in the urban, suburban, and rural areas.
3. *Same teacher for both classes*. The researcher taught both classes in the study. She may have had a bias in teaching the CPMP additional curriculum to the treatment group. To control for her bias, she taught the control group first and then the treatment group. Further research could train teachers in the CPMP approach and replicate the study in two schools to control for bias in the instructional method. Using different teachers and different schools should control this threat to the internal validity of the design.
4. *Communication between the treatment and control groups*. The students in both groups were ninth grade students in an Algebra 1 course. Although the students were assigned to two different classes, they may have interacted with each other in other classes and compared notes regarding what they had learned in their algebra classes. To control for this interaction, further research is needed with the study conducted in two or more schools to control for the interaction effect. Each school should use one type of instruction (either traditional or CPMP) to further control interaction between instructional methods.
5. *Number of at-risk students in the study.* This study was conducted at a magnet school where students have to take a district test to enter the school. Future studies should include at-risk students and use those students as a separate group in the

المنارة للاستشارات
www.manaraa.com

analyses to determine the CPMP curriculum's impact on that specific group of students.

6. *Textbook distribution.* The CPMP textbooks, student resources, teacher guides, and teacher resources were purchased by the researcher. Future studies should include the school districts covering the cost of all textbooks and supplemental resources. Grants should also an option to defray the cost of textbooks and materials. Future studies should also include school districts purchasing computers and installing textbooks on those computers.
7. The findings of this study led to the conclusion that students' perceptions of the CPMP did not always match their use of the CPMP methods. Students were not always in favor of using the CPMP, which might have been due to them not using it until the second half of the school semester. If students had begun using the CPMP in the beginning of the school year, their perceptions may have been more positive. Future research could investigate differences in mathematics performance between two classes of students with the study taking place over the entire school year. By using the CPMP methods for the entire year, students in the intervention group would not have been exposed to the traditional method of teaching algebra.
8. *Gender, Race/Ethnicity, and Socio-Economic Status (SES) of Students:* This study was limited to only two classes in an urban school district. Future studies should include a larger number of schools where studies on standards based teaching can be done to find the interaction between the groups and gender, race/ethnicity, and SES.

Final Note

When taught using the CPMP curriculum, students appeared to develop a deeper knowledge of algebraic concepts than when taught using the traditional curriculum. The

المنارة للاستشارات
www.manaraa.com

differences did not extend to procedural knowledge as the steps used to solve algebraic problems are standardized, regardless of the teaching method. This study provided support that students need to have concepts taught using a method, such as the Core Plus Mathematics Project.

المنارة للاستشارات
www.manaraa.com

APPENDIX A

DEMOGRAPHIC SURVEY

Please put a check mark by the following statements.

1. I am a citizen of: ☐ United States

   ☐ Other If Other, please state the country of which you are citizen. _____

2. I am: ☐ Male ☐ Female

3. I am: ☐ White, Non-Hispanic

   ☐ African American

   ☐ Hispanic, If so, what nationality_____

   ☐ American Indian

   ☐ Asian & Pacific Islander

   ☐ Others, specify: _____

المنارة للاستشارات
www.manaraa.com

APPENDIX B

Perceptions of CPMP Mathematics Instruction: Student Survey (treatment group only)

This survey has two parts: In Part I, the survey ask you about your perceptions regarding the use of the CPMP curriculum. Part II is a short answer questionnaire that asks you about your learning experience with the CPMP curriculum. Please take a few minutes to answer the survey. Thank you. You have the right to skip any question which you do not care to answer. After reading the statement below, put a check mark under the statement which best reflects your thoughts.

Survey Questions	Not at all	A little	Moderately well	Well	Very Well
Using the Algebra I textbook and Core-Plus materials were easy for me.					
Using the Core-Plus materials helped me learn mathematics.					
I believe using the Core-Plus materials made mathematics tests easier.					
I would like to have a program like CPMP to use for other subjects I study.					
I believe Core-Plus can be taught to any student.					
I like using the CPMP method.					
I will use my CPMP skills that I have acquired in class outside of school.					
Members of my family are interested in knowing more about CPMP.					
Using CPMP made learning mathematics more fun.					

المنارة للاستشارات
www.manaraa.com

Short Answer:

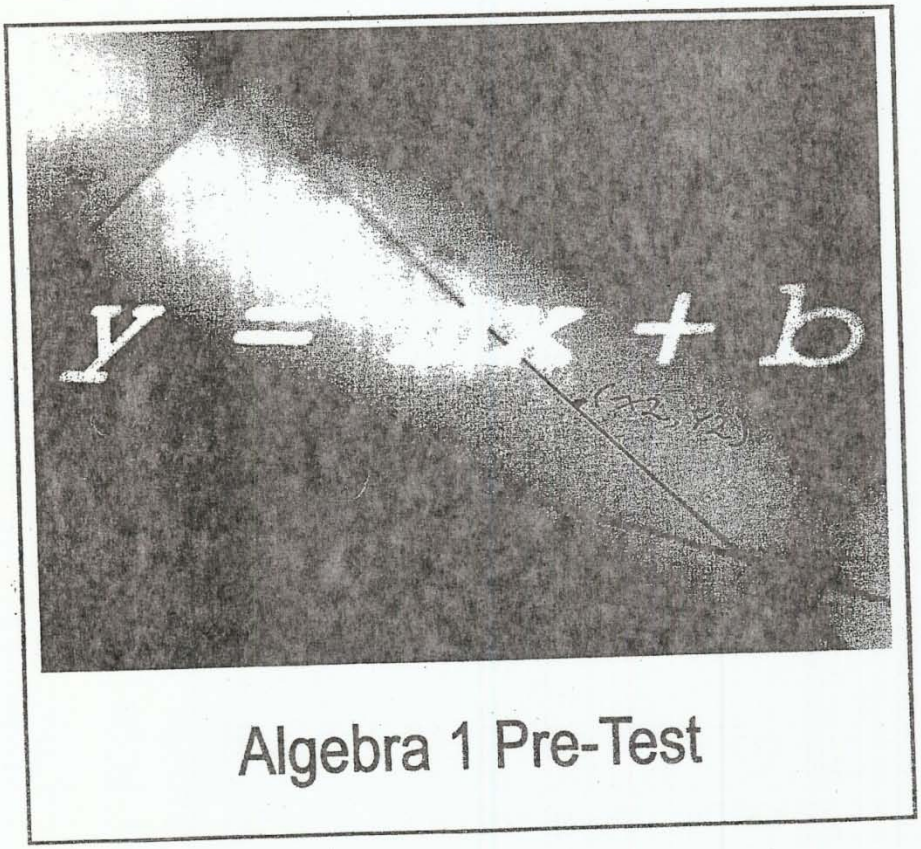
1. What part of CPMP did you like best?
2. What part of CPMP did you like least?
3. What lesson in CPMP did you learn the most?
4. What lesson in CPMP did you learn the least?
5. How often did you discuss CPMP with family members?
6. What was emphasized in the discussions?
7. How often did you discuss CPMP with classmates outside of the class?
8. What was emphasized in the discussions?

المنارة للاستشارات
www.manaraa.com

APPENDIX C-PRETEST

MATHEMATICS

High School Secondary Credit Assessment



Algebra 1 Pre-Test

OFFICE OF MATHEMATICS EDUCATION

Detroit Public SCHOOLS

المنارة للاستشارات
www.manaraa.com

The Office of Mathematics Education designed this assessment in compliance with state guidelines. Permission is granted to secondary schools to reproduce classroom sets of this assessment as a pre-test for DPS Algebra 1.

For all instances other than identified in the previous paragraph, no part of this publication may be reproduced, stored in a retrieval system, or transmitted, in any form or by any means, electronic, mechanical, photocopying, recording, or otherwise, without prior written permission from the Office of Research and Evaluation.

المنارة للاستشارات

www.manaraa.com

1. Divide $-108 \div -9$

   A. -117
   B. -12
   C. 12
   D. 117

2. Multiply $\frac{-4}{5} \bullet \frac{-1}{3}$

   A. $\frac{-5}{8}$
   B. $\frac{-4}{15}$
   C. $\frac{4}{15}$
   D. $\frac{5}{8}$

3. Which of the following is closest to the value of the expression below?

   $-71.83 \div -9.26$

   A. -10
   B. -8
   C. 8
   D. 10

المنارة للاستشارات

www.manaraa.com

4. Stefan rode a bike a total of 17.5 miles in 7 hours at a constant speed. What was Stefan's speed?

   A. 0.4 mile per hour

   B. 2.5 miles per hour

   C. 10.5 miles per hour

   D. 24.5 miles per hour

5. Jeremy has exactly $100 saved. Starting today, he will earn $8 a week for doing chores. Jeremy plans to save all of his money. Which equation *best* represents, y, the total amount of money he should have saved after x weeks?

   A. $y = 8x$

   B. $y = 100x$

   C. $y = 8x + 100$

   D. $y = 100x + 8$

6. The table below shows some information about a car driving at a constant speed on an interstate highway.

Distance vs. Time

Time (in hours)	0.5	1.0	1.5	2.0	2.5	3.0
Distance (in miles)	30	60	90	120	150	180

Which equation represents the relationship shown in the table between, d, distance, and, t, time?

   A. $d = 0.5t$

   B. $d = 1t$

   C. $d = 30t$

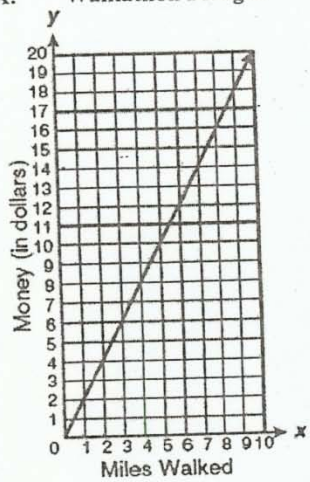
   D. $d = 60t$

المنارة للاستشارات

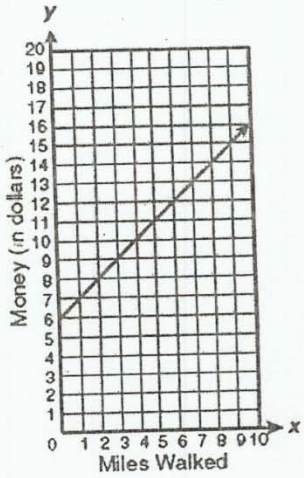
www.manaraa.com

7. A walkathon requires \$6 to enter and \$1 for each mile complete. Which of the following graphs shows this relationship?

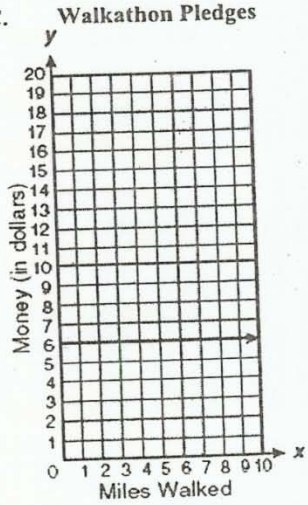
A. **Walkathon Pledges**



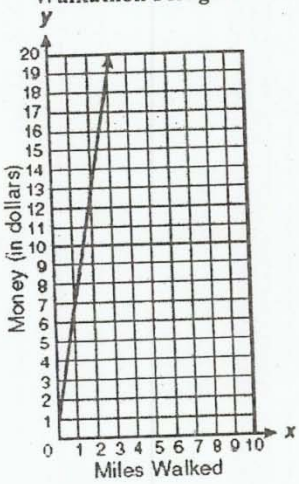
B. **Walkathon Pledges**



C. **Walkathon Pledges**



D. **Walkathon Pledges**



المنارة للاستشارات

www.manaraa.com

8. Jake is making lemonade for the school picnic. It takes 4 pints of lemonade mix to serve 15 students. At that rate, how many pints of lemonade mix would be needed to serve 150 students?

   A. 40
   B. 60
   C. 210
   D. 600

9. The square root of 75 is between which two numbers?

   A. 4 and 5
   B. 8 and 9
   C. 18 and 19
   D. 37 and 38

10. The temperature at sunrise on Tuesday was -4°C. It increased 12°C by noon. What was the temperature at noon?

   A. -16°C
   B. -8°C
   C. 8°C
   D. 16°C

11. What is the additive inverse of 7?

   A. 7
   B. 1
   C. 0
   D. -7

المنارة للاستشارات
www.manaraa.com

12. What is the multiplicative inverse of 4?

A. -4

B. 1

C. $\frac{1}{4}$

D. $-\frac{1}{4}$

13. Which expression is equivalent to the following?

$$3(8x-2y+7)$$

A. $24x-2y+7$

B. $24x-6y+21$

C. $8x-6y+21$

D. $11x-5y+10$

14. Mia's Bike Shop rents skates for \$3.00 per hour plus a \$5.00 fee. Marcie has exactly \$14.00. Which equation could Marcie use to determine, x, the total number of hours for which she could rent a pair of skates?

A. $5x+3=14$

B. $3x+5=14$

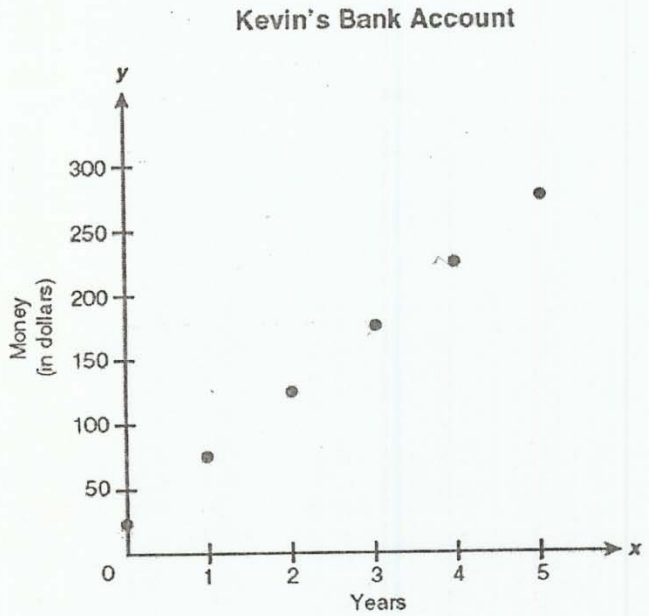
C. $3x+5x=14$

D. $5+3=14x$

المنارة للاستشارات

www.manaraa.com

15. Starting the year he was born, Kevin's parents have put money into his bank account every year. Based on the graph below, which statement best describes the amounts of money Kevin's parents have put in the bank account?



A. $25 at birth and $25 each year

B. $25 at birth and $50 each year

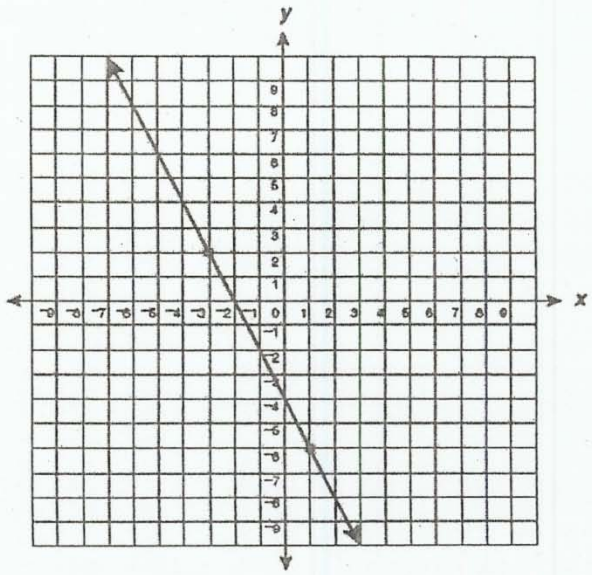
C. $50 at birth and $25 each year

D. $50 at birth and $50 each year

المنارة للاستشارات

www.manaraa.com

16. Which appears to be slope of the line graphed on the grid below?



A. -2

B. $-\frac{1}{2}$

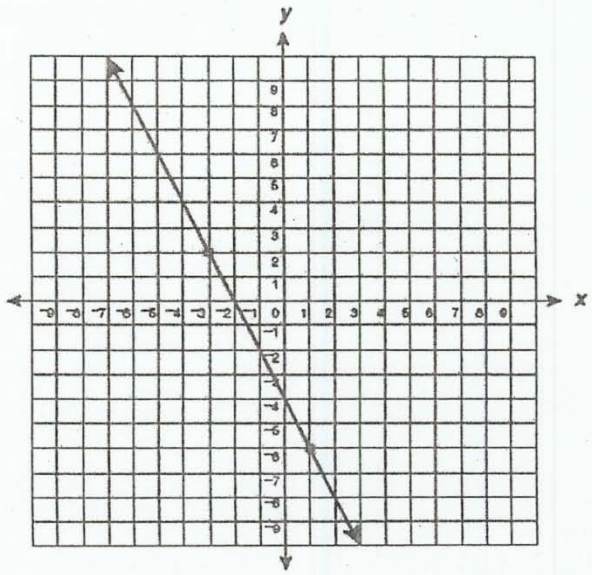
C. $\frac{1}{2}$

D. 2

المنارة للاستشارات

www.manaraa.com

16. Which appears to be slope of the line graphed on the grid below?



A. -2

B. $-\frac{1}{2}$

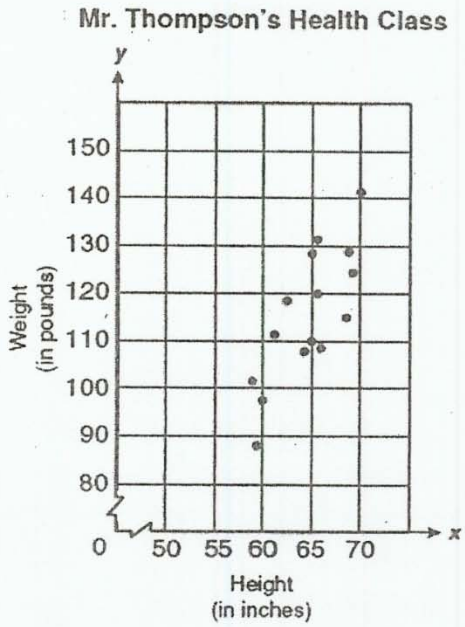
C. $\frac{1}{2}$

D. 2

المنارة للاستشارات

www.manaraa.com

17. The scatter plot below shows the relationship between the height and the weight for each of 15 students in Mr. Thompson's health class.



According to the scatter plot, which is closest to the height of a student who weighs approximately 115 pounds?

A. 56 inches

B. 59 inches

C. 67 inches

D. 75 inches

المنارة للاستشارات
www.manaraa.com

18. Select the linear function that represents the data listed below in the table.

x	$f(x)$
0	0
1	3
2	6
3	9
4	12

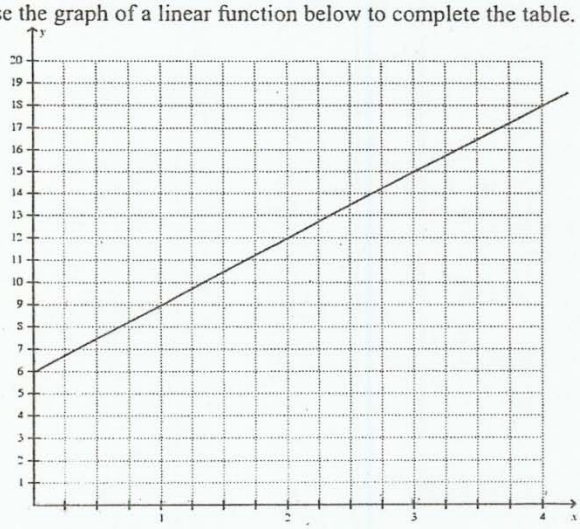
A. $f(x) = x + 4$

B. $f(x) = 2x + 2$

C. $f(x) = 3x$

D. $f(x) = x + 4$

19. Use the graph of a linear function below to complete the table.



x	y
	6
1	
	12
3	

A. {(24,6), (1,9), (2,12), (3,5)}

B. {(0,6), (1,9), (2,12), (3,15)}

C. {(6,6), (1,9), (2,12), (3,15)}

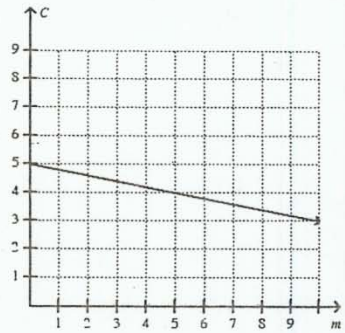
D. {(0,6), (1,7), (5,12), (3,9)}

المنارة للاستشارات
www.manaraa.com

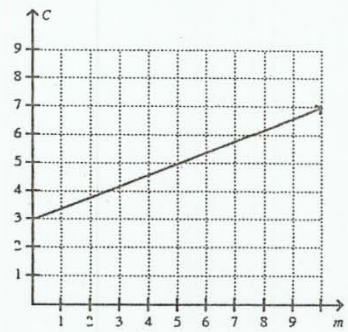
20. Beach Bike Rental charges \$5.00 plus \$0.20 per miles to rent a bike. The equation for this situation with the total cost C of renting the bike and riding for m miles is $C = 5 + 0.2m$.

Which graph represents the cost of renting at Beach Bike Rentals?

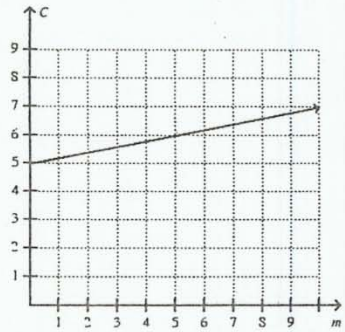
A.



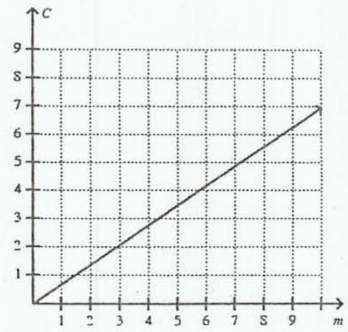
C.



B.



D.



المنارة للاستشارات

www.manaraa.com

21. What is the slope of the function given by the input-output table?

Input, x	8	10	12	14	16
Output, y	5	7	9	11	13

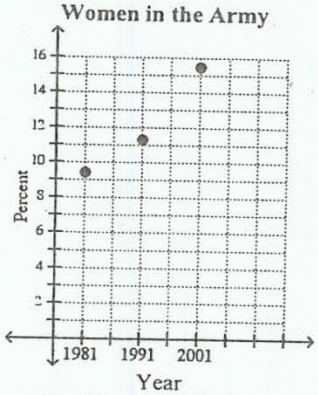
A. positive slope

B. negative slope

C. zero slope

D. undefined slope

22. Determine whether the scatter plot graph shows a positive correlation, a negative correlation, or no correlation. If positive or negative correlation, describe its meaning in the situation.



Source: Time Magazine, March 24, 2003

A. positive; as time goes on, more women are in the army.

B. no correlation

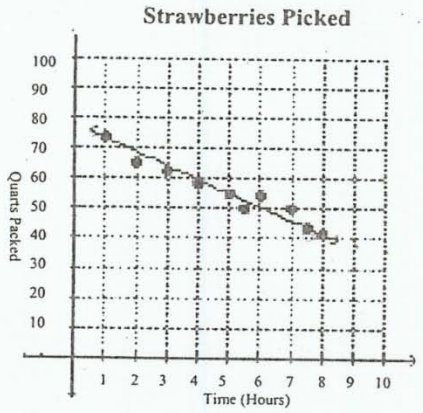
C. negative; as time goes on, fewer women are in the army.

D. negative; as time goes on, more women are in the army.

المنارة للاستشارات

www.manaraa.com

23. Use the scatter plot that shows the number of quarts of strawberries picked each hour. Predict the number of quarts that will be picked in the tenth hour.



A. about 12 quarts

B. about 25 quarts

C. about 35 quarts

D. about 42 quarts

24. A hot dog stands sells foot-long hot dogs for \$2.50 and 6-inch hot dogs for \$1.50. The stand makes \$54 in one day. Which equation models the situation?

A. $2.50x - 1.50y = 54$

B. $2.50x + 1.50y = 54$

C. $y = -1.67x - 36$

D. $y = -1.50 - 54(x - 2.50)$

المنارة للاستشارات
www.manaraa.com

25. Your club decides to sell candy to raise money. Each box cost \$2.50 and there is a one time delivery fee of \$30. The club plans to sell the candy for \$4.50 per box. Use the equation $2.50x + 30 = 4.50x$. How many boxes of candy must be sold to cover the cost?

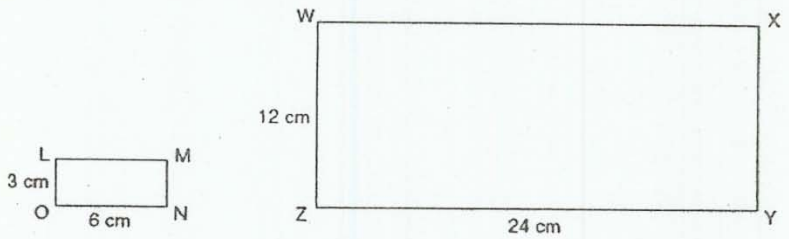
A. 6 boxes

B. 10 boxes

C. 15 boxes

D. 18 boxes

26. Rectangle LMNO is similar to rectangle WXYZ.



What is the scale factor from rectangle LMNO to rectangle WXYZ?

A. 2

B. 4

C. 9

D. 18

المنارة للاستشارات
www.manaraa.com

27. A model car is built using a scale of 1 centimeter represents 2 feet. If the length of the model car is 5.5 centimeters, what is the length of the actual car?

A. 3.0 ft

B. 5.5 ft

C. 7.5 ft

D. 11.0 ft

28. Li Min recorded the number of customers that came to her lemonade stand each day. The results are displayed in the stem and leaf plot below.

Number of Customers

Stem	Leaf
1	0 3 3 7
2	6 8
3	2 3 7
4	1

Key
2 | 6 represents 26

What was the range for the number of customers?

A. 13

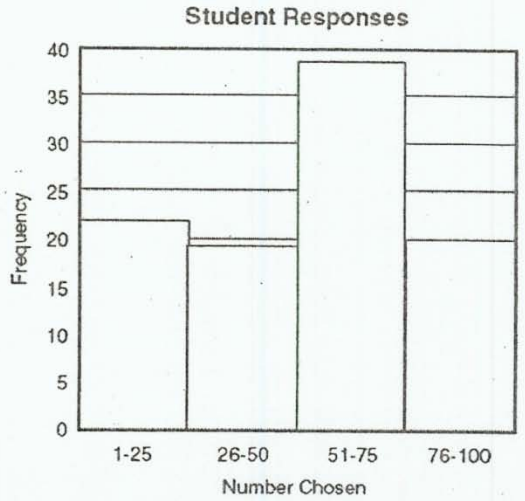
B. 25

C. 27

D. 31

المنارة للاستشارات
www.manaraa.com

29. Daniel asked 100 students in his school's cafeteria to name a whole number between 1 and 100. The students' responses are shown in the histogram below.



What is the relative frequency of students who named a number greater than 75?

A. 0.20

B. 0.35

C. 0.75

D. 0.80

المنارة للاستشارات
www.manaraa.com

30. Mrs. Lee asked the 25 students in her class to choose their favorite color. The responses she received are in the table below.

Students' Favorite Color

Favorite Color	Number of Students
Red	5
Orange	2
Blue	7
Green	10
Purple	1

What is the relative frequency of students who chose red as their favorite color?

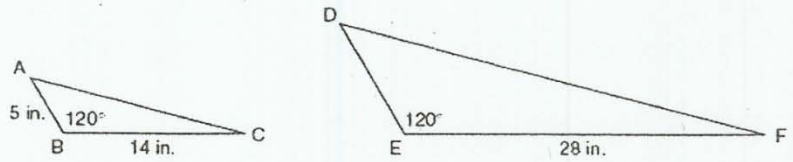
A. 0.25

B. 0.20

C. 0.10

D. 0.05

31. The diagram shows some measurements of triangle ABC and triangle DEF.



For Triangle ABC and Triangle DEF to be similar, which must be true?

A. DF = 10 inches

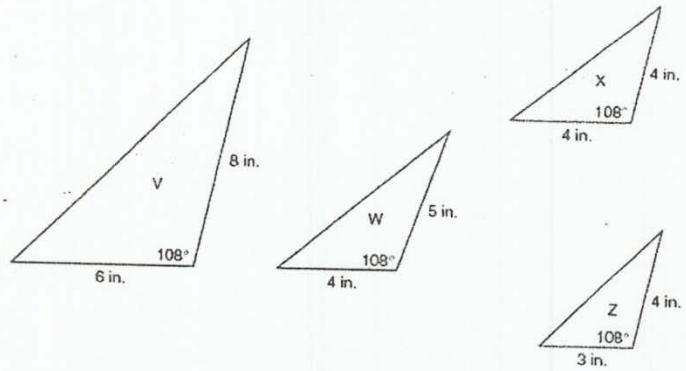
B. DF = 19 inches

C. DE = 10 inches

D. DE = 19 inches

المنارة للاستشارات
www.manaraa.com

32. The largest angle in all of the triangles below measures 108°. Which two triangles are similar to each other?



A. V and W

B. W and Z

C. W and X

D. V and Z

33. What is the median of the set of data shown below?

Stem	Leaf
1	3 4
2	1 3 6 7
3	2 4 6 6 8
4	0 1 2 2

Key
3 | 2 represents 32

A. 29

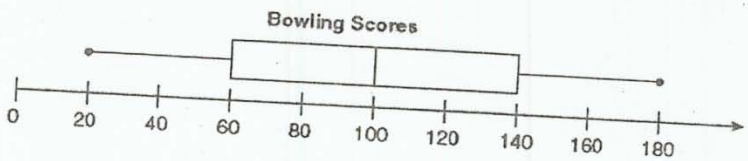
B. 31

C. 34

D. 36

المنارة للاستشارات
www.manaraa.com

34. Which appears to be the interquartile range for the data used to create the following box-and-whisker plot?



A. 60

B. 80

C. 100

D. 160

35. What is the slope and y-intercept of the graph of the equation $10x - y = -4$

A. m = -10, b = -4

B. m = -10, b = 4

C. m = 10, b = -4

D. m =10, b = 4

If you finish early, you may go back and check your work.

المنارة للاستشارات

www.manaraa.com

APPENDIX D

Examination One: Chapter 5: Writing Linear Equations

Course: Algebra II Student's Name_____

Teacher: K. Harvel Date_____ Period_____

Write an equation of the line with the given slope and y-intercept. Write the equation in slope-intercept form.

1. $m = \frac{1}{4}$, $b = -3$ (5 pts) 2. $m = -3$, $b = 3$ (5 pts)

Write an equation of the line that passes through the given point and has the given slope. Write the equation in slope-intercept form.

3. (4, -2), $m = \frac{1}{2}$ (7 pts) 4. (-5, -6), $m = -3$ (7 pts)

Write the equation of the line in slope-intercept form.

5. (-5, 2), (2, 4) (10 pts)

Write an equation in point-slope form of the line that passes through the two points. **<u>Then</u>** write the equation in slope-intercept form.

6. (1, -2), (-1, 8) (10 pts)

Rewrite the equation in standard form with integer coefficients.

7. $y = -\frac{1}{3}x + \frac{2}{3}$ (6 pts)

Nutrition Data							
Item	Grams	Total Calories	Fat Calories From Fat	Item	Grams	Total Calories	Fat Calories From Fat
McDonald's				**Wendy's**			
Mclean Deluxe	12	350	110	Chicken	20	450	180

المنارة للاستشارات
www.manaraa.com

Sandwich			Sandwich		
Filet O'Fish Sandwich	16	360	Bake Potato w/ Broccoli & Cheese	14	460
McLean Deluxe & Small Fries	22	560	Taco Salad	30	580
KFC			**Hardee's**		
Skin Free Crispy Breast	17	293	Fishman's Fillet	20	450

Many Americans love to eat fast food. But we also are concerned about weight gain and the cholesterol that is generated by eating saturated fat. Many fast-food restaurants now advertise special "lite" menus. They give information about the fat and calorie content of those foods, like the data in the table above.

8. Make a scatterplot of data relating gram **F** of fat to total calories **T** in the menu items shown.

(10 pts)

9a. Draw a linear model joining the points (12, 350) and (30, 580). (5 pts)

9b. Find its equation in the form of **T** = b**F** + a. (10 pts)

9c. Explain what the values of *a* and *b* tell about the model graph and about the relation between grams of fat and total calories in the food items. (10 pts)

10a. Use your graphing calculator to find the linear regression model for the (**F, T**) data in the table. (10 pts)

10b. Compare this result to what you found in part 10b. (5 pts)

المنارة للاستشارات
www.manaraa.com

APPENDIX E

Rubric for Examination One

Chapter 5: Writing Linear Equations

High School Content Expectations (HSCE):

1. L1.2.4: Organize and summarize a data set in a table, plot, chart, or spreadsheet; find patterns in a display of data; understand and critique data displays in the media.
2. A1.2.1: Write equations and inequalities with one or two variables to represent mathematical or applied situations, and solve.
3. A2.4.1: Write the symbolic forms of linear functions (standard [i.e. Ax + By = C, where B $\neq$ 0], point-slope, and slope-intercept) given appropriate information, and convert between forms.
4. A2.4.3: Relate the coefficients in a linear function to the slope and x- and y-intercepts of its graph.

Procedural Knowledge			Conceptual Knowledge		
Problem Number	Points	HSCE Item Number	Item Number	Points	HSCE Item Number
1	5	2, 3, 4	8	10	1, 2, 3, 4
2	5	2, 3, 4	9a	5	1, 2, 3, 4
3	7	2, 3, 4	9b	10	1, 2, 3, 4
4	7	2, 3, 4	9c	10	1, 2, 3, 4
5	10	2, 3, 4	10a	10	1, 2, 3, 4
6	10	2, 3, 4	10b	5	1, 2, 3, 4

المنارة للاستشارات
www.manaraa.com

7 6 2, 3, 4	
Total Number of Items: 13	Student's Total Number of Correct Items: Student's Total No. of Partially Correct Items:
Total Number of Points: 100	Student's Total Number of Points:

90-100	A
80-89	B
70-79	C
60-69	D
Below 59	F

المنارة للاستشارات
www.manaraa.com

APPENDIX F

Examination Two: Chapter 6: Solving and Graphing Linear Inequalities

Course: Algebra II Student's

Name_____

Teacher: K. Harvel Date_____ Period_____

Solve the inequality. **Then** graph the solution on the number line.

1. $6 - x > 15$ (5 pts)

2. $\frac{2}{3}x + 2 \leq 4$ (5 pts)

Solve the inequality. **Then** write a sentence that describes the solution.

2. $-3 \leq 4x + 5 \leq 7$ (10 pts)

Sentence_____

4. $6x + 9 \geq 21$ or $9x - 5 \leq 4$ (10 pts)

Sentence _____

5. $|4x + 5| - 6 \leq 1$ (5 pts)

Sketch the graph of the inequality. (Hint: Use a rectangular coordinate system)

6. $3x + 4y \geq 12$ (10 pts)

Choosing a Shampoo Shampoos Labeled "for Normal Hair"	Price ($)	Size (oz)	Cost per Ounce ($ per oz)
Denorex Medicated Regular	6.32	8	.79
Paul Mitchell Shampoo Three	5.07	8	.63
Johnson's Baby	2.89	15	.19
Faberge Organics Normal	1.31	15	.09
Jhmirmack Fabulously Clean All Hair Types	4.09	11	.37
Paul Mitch Awapuhi	3.93	8	.49
Bio Pure Jojoba with Keratin	3.25	16	.20
Halsa Balanced Care	2.42	15	.16
Pantene Normal	3.84	7	.55
Redken Glypro-L	6.25	9	.69
Finesse Regular	3.48	15	
Revlon Flex Normal to Dry	2.03	15	.14
Alberto VO5 Normal	1.30	15	.09

المنارة للاستشارات
www.manaraa.com

Choosing a Shampoo Shampoos Labeled "for Normal Hair"	Price ($)	Size (oz)	Cost per Ounce ($ per oz)
Tegrin Medicated Advanced Formula	5.72	6.6	.87
Paul Mitchell Shampoo One	3.55	8	.44
Ivory Free Normal	1.90	15	.13
Salon Selectives Level 5	2.39	15	.16
Prell Normal	3.46	15	
Agree New Advanced Regular	2.95	15	.20
Head & Shoulder Concentrate Normal to Dry	3.54	5.5	.64
Head & Shoulder Normal to Dry	4.26	15	.28
Safebrands Normal	2.89	16	.18
Vidal Sassoon Normal	3.54	11	.32
Selsun Blue Dandruff Regular	5.69	7	.81
Neutrogena All Hair Types	5.08	6	.85
Prell Concentrate Normal to Dry	3.29	7	.47
Nexxus Therappe	8.05	16	.50
Suave Normal to Dry	1.21	16	.08
Avon Simply Brilliant Normal	1.99	15	.13
Silkience Regular/Frequency	3.22	15	.21
White Rain Regular	1.28	15	.09

7. The table above gives the price and size of shampoos as reported in *Consumer Reports, June 1992.*

4a. The cost per ounce is missing for Prell Normal and for Finesse Regular. Compute those values. (5 pts)

4b. Organize the data in the "Cost per Ounce" column by making a stem-and-leaf plot. (10pts)

4c. At about what percentile is Johnson's Baby Shampoo? (5 pts)

4d. Are there any outliers in the cost-per-ounce data? (5 pts)

المنارة للاستشارات
www.manaraa.com

4e. Examine the stem-and-leaf plot and make a sketch of what you think the box plot of the same data will look like. Then, make the box plot, either by hand or by graphing calculator, and check you sketch. (10 pts)

4f. What information about shampoos can you learn from the stem-and-leaf plot that you cannot from the box plot? What information about shampoos can you learn from the box plot that you cannot from the stem-and-leaf plot? (10 pts)

4g. Why is it more reasonable to plot the cost-per-ounce data than the price data? (10 pts)

المنارة للاستشارات
www.manaraa.com

APPENDIX G

Rubric for Examination Two

Chapter 6: Solving and Graphing Linear Inequalities

High School Content Expectations (HSCE):

1. L1.2.4: Organize and summarize a data set in a table, plot, chart, or spreadsheet; find patterns in a display of data; understand and critique data displays in the media.
2. A1.2.1: Write equations and inequalities with one or two variables to represent mathematical or applied situations, and solve.
3. A1.2.4: Solve absolute value Equations and inequalities, (e.g. solve $|x - 3| \leq 6$), and justify steps in the solution.
4. A2.1.3: Represent functions in symbols, graphs, tables, diagrams, or words, and translate among representations.

Procedural Knowledge			Conceptual Knowledge		
Problem Number	Points	HSCE Item Number	Item Number	Points	HSCE Item Number
1	5	2, 4	7a	5	1, 4
2	5	2, 4	7b	10	1, 4
3	10	2, 4	7c	5	4
4	10	2, 4	7d	5	4
5	5	2, 3, 4	7e	10	1, 4
6	10	2, 3, 4	7f	10	1, 4
			7g	10	4

المنارة للاستشارات
www.manaraa.com

Total Number of Items: 13	Student's Total Number of Correct Items: Student's Total No. of Partially Correct Items:
Total Number of Points: 100	Student's Total Number of Points:

90-100	A
80-89	B
70-79	C
60-69	D
Below 59	F

المنارة للاستشارات
www.manaraa.com

APPENDIX H

Examination Three: Chapter 7: Systems of Linear Equations and Inequalities

Course: Algebra II Student's

Name_____

Teacher: K. Harvel Date_____ Period_____

(For #1-4, each problem is worth 10 pts. For 5a-e, each problem is worth 6 pts.)

1. Graph and check to solve the linear system.

a. $y = -x + 3$

$y = -6$

b. $6x + 2y = 16$

$-2x + y = -2$

2. Use the substitution method to solve the linear system.

a. $2x + y = 4$

$- x + y = 1$

b. $– 3a + b = 4$

$- 9 a + 5b = -1$

3. Use the linear combination method to solve the linear system.

a. $-7x + 2y = -5$

$10x – 2y = 6$

b. $5y – 3x = 1$

$4y + 2x = 80$

4. Graph the system of linear inequalities.

$-x + 3y \leq 15$

$9x \geq 27$

المنارة للاستشارات

www.manaraa.com

5. City Telephone Company charges $9.00 per month plus $0.15 per call. Alex Telephone Company charges $15.00 per month plus $0.10 per call. For both companies, the monthly charge is a function of the number of calls made.

a. Write linear equations giving the relations between number of calls and monthly charge for each company.

b. Compare the monthly charges by each company for 95 calls.

c. How many calls could you make in a month for $40 under the pricing plans of the two companies?

d. For what number of calls is City Telephone more economical? For what number of calls is Alex Telephone more economical?

e. Which plan would cost less for the way your family uses the telephone?

المنارة للاستشارات
www.manaraa.com

APPENDIX I

Rubric for Examination Three

Chapter 7: Systems of Equations and Inequalities

High School Content Expectations (HSCE):

1. A1.2.1: Write equations and inequalities with one or two variables to represent mathematical or applied situations, and solve.
2. A2.4.2: Graph lines (including those of the form *x=h* and *y=k)* given appropriate information.

Procedural Knowledge			Conceptual Knowledge		
Problem Number	Points	HSCE Item Number	Item Number	Points	HSCE Item Number
1a	10	1, 2	5a	6	1
1b	10	1, 2	5b	6	1, 2
2a	10	1	5c	6	1
2b	10	1	5d	6	1, 2
3a	10	1	5e	6	1
3b	10	1			
4	10	1, 2			
Total Number of Items: 12			Student's Total Number of Correct Items: Student's Total No. of Partially Correct Items:		

المنارة للاستشارات
www.manaraa.com

Total Number of Points: 100	Student's Total Number of Points:

90-100	A
80-89	B
70-79	C
60-69	D
Below 59	F

المنارة للاستشارات
www.manaraa.com

APPENDIX J

Final Examination

Chapter 5: Writing Linear Equations

Chapter 6: Solving and Graphing Linear Inequalities

Chapter 7: Systems of Linear Equations and Inequalities

Course: Algebra II Student's Name_____

Teacher: K. Harvel Date_____ Period_____

1. Write an equation of the line that passes through the point and has the given slope.

a. (5, -6), m = 7 (7 pts) b. (-8, 5), m = 3 (7 pts)

2. Write the slope-intercept form of an equation of the line that passes through the points.

(2, 9), (-4, -2) (10 pts)

3. Solve the inequality and graph its solution.

a. $\frac{5}{6} + x > 2$ (10 pts) b. $-7x \leq 28$ (10 pts)

4. Solve the inequalities.

a. $9 - 4x \geq -13$ (5 pts) b. $6 \leq 2x + 3 \leq 10$ (9 pts) c. $|6 + x| < 7$ (9 pts)

5. The following data show sales by a concession stand at a baseball stadium during the first 11 days of the season.

Sales ($): 225, 160, 180, 200, 240, 110, 150, 180, 110, 140, 90.

a. Make a stem-and-leaf plot for the data. List the data in increasing order. (5 pts)
b. Find the mean, median, and mode of the data. (9 pts)
c. Find the first, second, and third quartiles. (9 pts)
d. Draw a box-and-whisker plot of the data. (10 pts)

6. Graph and check to solve the linear system. (10 pts)

$x + 8y = 8$

$2x + 6y = 6$

7. Use the substitution method to solve the linear system. (10 pts)

$x + 4y = 8$

$4x - 2y = -6$

8. Use the linear combination method to solve the linear system. (10 pts)

المنارة للاستشارات
www.manaraa.com

$3x + 5y = 12$

$-2x + 7y = -27$

9. Graph the system of linear inequalities. (10 pts)

$x + y < 6$

$x - y < 1$

$y \geq -5$

10. The following gives list prices for Toyota Celicas and Mercury Cougars.

Car Prices (in dollars)

Year	Base Price: Toyota Celica	Base Price: Mercury Cougar	Year	Base Price: Toyota Celica	Base Price: Mercury Cougar
1979	5899	5524	1989	11,808	15,448
1981	6699	7009	1991	12,698	16,094
1983	7299	9809	1993	14,198	14,855
1985	8449	10,650	1995	15,775	14,900
1987	10,598	13,595	1996	17,150	16,350

a. Make a scatter plot of the Toyota Celica (*year, price*) data. Draw what you believe will be a good linear model for that pattern. It will simplify your work if you treat 1979 as year 1 on the time axis and scale the price axis in $1,000 units. (10 pts)
b. Compute the slope and y-intercept of the linear regression model. (4 pts)
c. Write the equation of the linear regression line. (8 pts)
d. What is the estimated rate at which Celicas increased in cost per year? (8 pts)
e. What price for a new Celica is predicted for 1980? 1984? 1994? (6 pts)
f. In what year is the new Celica price predicted to exceed $17,500? (8 pts)
g. For how many years is the price of a new Celica ($17,500) predicted to stay under $20,000? (8 pts)
h. What factors might cause actual prices to differ form predicted prices? (8 pts)

المنارة للاستشارات
www.manaraa.com

APPENDIX K

Rubric for Final Examination

Chapter 5: Writing Linear Equations

Chapter 6: Solving and Graphing Linear Inequalities

Chapter 7: Systems of Linear Equations and Inequalities

High School Content Expectations (HSCE):

1. L1.2.4: Organize and summarize a data set in a table, plot, chart, or spreadsheet; find patterns in a display of data; understand and critique data displays in the media.
2. A1.2.1: Write equations and inequalities with one or two variables to represent mathematical or applied situations, and solve.
3. A1.2.4: Solve absolute value Equations and inequalities, (e.g. solve $|x - 3| \leq 6$), and justify steps in the solution.
4. A2.1.3: Represent functions in symbols, graphs, tables, diagrams, or words, and translate among representations.
5. A2.4.3: Relate the coefficients in a linear function to the slope and *x*- and *y*-intercepts of its graph.
6. A2.4.1: Write the symbolic forms of linear functions (standard [i.e. $Ax + By = C$, where $B \neq 0$], point-slope, and slope-intercept) given appropriate information, and convert between forms.
7. A2.4.2: Graph lines (including those of the form $x=h$ and $y=k$) given appropriate information.

المنارة للاستشارات
www.manaraa.com

Procedural Knowledge			Conceptual Knowledge		
Problem Number HSCE	Points	Item Number	Item Number HSCE	Points	Item Number
1a	7	2, 5,6	10a	10	1, 4
1b	7	2, 5, 6	10b	4	2, 5, 6
2	10	2, 5, 6	10c	8	2, 5, 6
3a	10	2, 7	10d	8	2, 5, 6
3b	10	2, 7	10e	6	2, 5, 6
4a	5	2, 4, 7	10f	8	2, 5, 6
4b	9	2, 4, 7	10g	8	2, 5, 6
4c	9	2, 3, 4	10h	8	2, 5, 6
5a	5	1, 4			
5b	9	1,4			
5c	9	1,4			
5d	10	1, 4			
6	10	2, 7			
7	10	2, 7			
8	10	2			
9	10	2, 7			
Total Number of Items: 24			Student's Total Number of Correct Items: Student's Total No. of Partially		

المنارة للاستشارات
www.manaraa.com

	Correct Items:
Total Number of Points: 200	Student's Total Number of Points:

179-200	A
159-178	B
139-158	C
119-138	D
Below 118	F

المنارة للاستشارات
www.manaraa.com

APPENDIX L

PARENTAL CONSENT, ADOLESCENT ASSENT FORM AND HIC'S APPROVAL

High School Content Expectation: The Relationship between Core-Plus Mathematics Project and Student Achievement

Study Investigator: Karen R. Treadway-Harvel

[School] Parental Permission/Research Informed Consent

Purpose:

You are being asked to allow your child to be in a research study at their school that is being conducted by Karen R. Treadway-Harvel, College of Education from Wayne State University. This study is being done to find out the effective use of a standards-based curriculum, called Core-Plus Mathematics (CPMP), which may influence student achievement. Your child will be taught from the district-mandated textbook, Algebra I (McDougall-Littell). Your child will be learning mathematics in a real-world context either through Core-Plus materials (standards-based curriculum) or other supplemental materials. There is evidence that the use of a standards-based curriculum has a positive impact on students' learning mathematics. Educators that have used standards-based curricula have shown significant improvement in student achievement. Your child has been selected for the study because the methods that will be used will assists your child in learning mathematics beginning in the 9th and continue on to the 12 grade.

Study Procedures:

If you decide to allow your child to take part in the study, your child will be in one group where they will learn from the Algebra I textbook or another group that will learn from the Algebra I textbook along with the CPMP textbook. All of the students will be given classwork, homework, three examinations, and a final examination. The group that is learning from the CPMP textbook will fill out a survey and a short response questions. The survey is a list of statements that asked students for their response to the Core-Plus materials. Students will remain in the study even though they have the option to skip any questions which they do not care to answer. At the beginning of the study, students will be given a pretest to ensure equity between the two classes. Once a week students will journal topics that are given by the researcher. The journal will take approximately 10-15 minutes. The journaling will be a part of the research. All students in the study will complete a demographic survey to ensure equity of the students.
No names will be disclosed. The study will be for approximately 12 weeks, 5 days a week, during the 55-minute class period, for a total of 60 visits. The journals, exams, and survey will be kept in a locked cabinet where the study will be held.

Benefits

You may benefit from being in this study by learning mathematics as it applies to real world situations. You will receive a benefit from the teaching methods, whether it is from the Algebra I textbook or from the Algebra I and Core-plus textbooks. Information gained from this study may help other people in the future by having additional research to justify that CPMP may have influence on student learning mathematics and overall student achievement.

Risks:

- There are no known risks at this time to your child for participation in this study.

Costs

There are no costs to you or your child to participate in this study.

Submission/Revision Date: [insert date] Page 1 of 3 Parent/Guardian Initials_____

المنارة للاستشارات
www.manaraa.com

High School Content Expectation: The Relationship between Core-Plus Mathematics Project and Student Achievement

Compensation

- You or your child will not be paid for taking part in this study.

Confidentiality:

All information collected about your child during the course of this study will be kept confidential to the extent permitted by law. All information collected about your child during the course of this study will be kept without any identifiers.

Voluntary Participation /Withdrawal:

Your child's participation in this study is voluntary. You may decide that your child can take part in this study and then change your mind. You are free to withdraw your child at any time. Your decision about enrolling your child in the study will not change any present or future relationships with Wayne State University or its affiliates, your child's school, your child's teacher, your child's grades or other services you or your child are entitled to receive.

Questions:

If you have any questions about this study now or in the future, you may contact Karen R. Treadway-Harvel at the following phone number (313) 416-4600. If you have questions or concerns about your rights as a research participant, the Chair of the Human Investigation Committee can be contacted at (313) 577-1628. If you are unable to contact the research staff, or if you want to talk to someone other than the research staff, you may also call (313) 577-1628 to ask questions or voice concerns or complaints.

Consent to Participate in a Research Study:
To voluntarily agree to have your child take part in this study, you must sign on the line below. If you choose to have your child take part in this study, you may withdraw them at any time. You are not giving up any of your or your child's legal rights by signing this form. Your signature below indicates that you have read, or had read to you, this entire consent form, including the risks and benefits, and have had all of your questions answered. You will be given a copy of this consent form.

Name of Participant	Date of Birth
Signature of Parent/ Legally Authorized Guardian	Date
Printed Name of Parent Authorized Guardian	Time
*Signature of Parent/ Legally Authorized Guardian	Date
Printed Name of Parent Authorized Guardian	Time
**Signature of Witness (When applicable)	Date

المنارة للاستشارات
www.manaraa.com

High School Content Expectation: The Relationship between Core-Plus Mathematics Project and Student Achievement

Printed Name of Witness	Time
Oral Assent (children age 7-12) obtained by	Date
Signature of Person Obtaining Consent	Date
Printed Name of Person Obtaining Consent	Time

* Both parent's signatures should be obtained however both are **required** for level 3 studies

** Use when parent/guardian has had consent form read to them (i.e., illiterate, legally blind, translated into foreign language).

APPROVAL PERIOD

FEB 0 5 '10 FEB 0 4 '11

HUMAN INVESTIGATION COMMITTEE

المنارة للاستشارات
www.manaraa.com

High School Content Expectations: The Relationship between the Core-Plus Mathematics Project and Student Achievement

Study Investigator: Karen R. Treadway-Harvel

[Behavioral]Documentation of Adolescent Assent Form

(ages 13-17)

Why am I here?
This is a research study. Only people who choose to take part are included in research studies. You are being asked to take part in this study because the methods that will be used in this study will assists you with learning in other subjects from grades 9 to 12. Please take time to make your decision. Talk to your family about it and be sure to ask questions about anything you don't understand.

Why are they doing this study?
This study is being done to find out the effective use of a standards-based curriculum, called Core-Plus Mathematics (CPMP), which may influence student achievement. You will be taught from the district-mandated textbook, Algebra I (McDougall-Littell). You will be learning mathematics in a real-world context either through Core-Plus materials or other supplemental materials. You will be taking three examinations and a final examination. The examinations will include problems where you must show all your steps. It will also include application problems that are related to the world around you.

What will happen to me?
There will be two groups of students, one group that receive just the Algebra I textbook, the other group will receive the Algebra I textbook and the Core-Plus textbook. You will be learning about Linear Functions. You will be using graphing calculators for analyzing data.

How long will I be in the study?
You will be in the study for 5 days a week, 55-minutes per day, for approximately 12 weeks.

Will the study help me?

- There may be benefits from you being in this study by learning about real world situations through the use of mathematics.

Will anything bad happen to me?
There are no risks in this study.

Do my parents or guardians know about this? (If applicable)
This study information has been given to your parents/guardian with more details related to the study. You can talk this over with them before you decide.

What about confidentiality?
Every reasonable effort will be made to keep your information confidential. But we do have to let some people look at your study records.

We will keep your information private unless we are required by law to share any information.

المنارة للاستشارات
www.manaraa.com

High School Content Expectation: The Relationship between Core-Plus Mathematics Project and Student Achievement

What if I have any questions?
For questions about the study please call Karen R. Treadway-Harvel at (313) 416-4600. If you have questions or concerns about your rights as a research participant, the Chair of the Human Investigation Committee can be contacted at (313) 577-1628.

Do I have to be in the study?
You don't have to be in this study if you don't want to or you can stop being in the study at any time. Please discuss your decision with your parents and researcher. No one will be angry if you decide to stop being in the study.

المنارة للاستشارات
www.manaraa.com

High School Content Expectation: The Relationship between Core-Plus Mathematics Project and Student Achievement

AGREEMENT TO BE IN THE STUDY

Your signature below means that you have read the above information about the study and have had a chance to ask questions to help you understand what you will do in this study. Your signature also means that you have been told that you can change your mind later and withdraw if you want to. By signing this assent form you are not giving up any of your legal rights. You will be given a copy of this form.

Signature of Participant (13 yrs & older) Date

Printed name of Participant (13 yrs & older)

**Signature of Witness (When applicable) Date

Printed Name of Witness

Signature of Person who explained this form Date

Printed Name of Person who explained form

APPROVAL PERIOD

FEB 05 '10 FEB 04 '11

HUMAN INVESTIGATION COMMITTEE

** Use when participant has had consent form read to them (i.e., illiterate, legally blind, translated into foreign language).

Submission/Revision Date: [insert date] Page 3 of 3 Participants Initials_____

Protocol Version #: [Insert Number]

HIC Date: 05/08

المنارة للاستشارات

www.manaraa.com

WAYNE STATE UNIVERSITY

HUMAN INVESTIGATION COMMITTEE
101 East Alexandrine Building
Detroit, Michigan 48201
Phone: (313) 577-1628
FAX: (313) 993-7122
http://hic.wayne.edu

Full AAHRPP Accreditation

NOTICE OF EXPEDITED APPROVAL

To: Karen Treadway-Harvel
College of Education

From: Ellen Barton, Ph.D. E. Barton /KS
Chairperson, Behavioral Institutional Review Board (B3)

Date: February 05, 2010

RE: HIC #: 0110810B3E
Protocol Title: High School Content Expectations: The Relationship Between Core-Plus Mathematics Project and Student Achievement
Sponsor:
Protocol #: 1001007998

Expiration Date: February 04, 2011

Risk Level / Category: 45 CFR 46.404 - Research not involving greater than minimal risk

The above-referenced protocol and items listed below (if applicable) were **APPROVED** following *Expedited Review* (Category 7*) by the Chairperson/designee *for* the Wayne State University Behavioral Institutional Review Board (B3) for the period of 02/05/2010 through 02/04/2011. This approval does not replace any departmental or other approvals that may be required.

- Assent Form
- School Parental Permission/Research Informed Consent

- Federal regulations require that all research be reviewed at least annually. You *may* receive a *"Continuation Renewal Reminder"* approximately two months prior to the expiration date; however, it is the Principal Investigator's responsibility to obtain review and continued approval ***before*** the expiration date. Data collected during a period of lapsed approval is unapproved research and can ***never*** be reported or published as research data.
- All changes or amendments to the above-referenced protocol require review and approval by the HIC **BEFORE** implementation.
- Adverse Reactions/Unexpected Events (AR/UE) must be submitted on the appropriate form within the timeframe specified in the HIC Policy (http://www.hic.wayne.edu/hicpol.html).

NOTE:

1. Upon notification of an impending regulatory site visit, hold notification, and/or external audit the HIC office must be contacted immediately.
2. Forms should be downloaded from the HIC website at ***each*** use.

*Based on the Expedited Review List, revised November 1998

المنارة للاستشارات
www.manaraa.com

APPENDIX M

DETROIT SCHOOL DISTRICT APPROVAL AND PARENT MEETING LETTER

DETROIT PUBLIC SCHOOLS

Office of Research, Evaluation, Assessment and Accountability
Albert Kahn Building
7430 Second Avenue – Suite 100
Detroit, MI 48202
Telephone: (313) 873-6602 • FAX (313) 873-6446

April 12, 2010

Karen Treadway-Harvel
20424 Ardmore Street
Detroit, MI 48235

Dear Ms. Treadway-Harvel:

The Detroit Public Schools' Outside Research Committee has met and reviewed your research proposal entitled, **"High School Content Expectations: The Relationship between Core-Plus Mathematics Project and Student Achievement."** We are pleased to inform you that your request to conduct research has been approved.

Please note the following:

- Classroom observations may not be conducted in your study.
- The attached parent consent form and adolescent assent form must be used during your study.
- Interviews may not be conducted during your study.
- The actual student journals may not be included in your dissertation; however a summation of the comments made without identifiers is permitted.
- A student teacher may not be used to distribute consent or assent forms during your study.

Please note the Office of Research, Evaluation, Assessment and Accountability will contact the selected school and inform you of the school's decision to participate or not to participate in the study. **No contact should be made with the requested school at this time.**

Thank you for including Detroit Public Schools in your study. If you have further questions, please call me at (313) 873-6602. We wish you much success in your pursuits.

Sincerely,

Sibyl St. Clair
Director of Research and Evaluation

Attachment

pc: Karen Ridgeway, Executive Director, Office of Research, Evaluation, Assessment and Accountability

SS/ch:04.12.10

المنارة للاستشارات
www.manaraa.com

DETROIT PUBLIC SCHOOLS

Renaissance High School
6565 West Outer Drive
Detroit, Michigan 48235
Ph.: 313-416-4600 Fax: 313-416-4620

April 13, 2010

Dear Parent(s)/Guardian(s),

I am a Ph.D. candidate from Wayne State University's Department of Education and I am conducting a study called *High School Content Expectations: The Relationship between the Core-Plus Mathematics Project and Student Achievement*. I would like to involve your child in my study. The purpose of this study is to examine the effective use of a standards-based curriculum, called the Core-Plus Mathematics Project (CPMP), which may influence student achievement. Your child is currently being taught from the district-mandated textbook, Algebra I, McDougal, Littell. Your child will continue to be taught from this textbook. The study will include your child learning mathematics in a real-world context either through Core-Plus materials or other supplemental materials. Your child has been selected for the study because s/he is learning mathematics in the 9th grade in Mrs. Treadway-Harvel's class.

I will hold a parents meeting, Thursday, April 15, 2010 from 6:00 p.m. to 7:00 p.m. in the lunchroom of Renaissance High. At the meeting, you will be given additional information about the study and a parent consent form for the study. If you have any questions concerning the meeting or the study, please call me at (313) 416-4600.

Thanking you in advance for your participation in this meeting.

Sincerely,

Karen R. Treadway-Harvel

Karen R. Treadway-Harvel

Mathematics Educator

Cc: Gail Russell-Jones

Antionette Pearson

Sharon Williams

المنارة للاستشارات
www.manaraa.com

REFERENCES

Achieve, Inc. (2002). Foundations for success: mathematics expectations for the middle grades. Retrieved October 28, 2006, fromhttp://www.achieve.org/files/MI-FullReport10-05-04.pdf

Adequate Yearly Progress. (2002). Retrieved August 26, 2004, from http://www.michigan.gov/mde/0,1607,7-140-22709 22875---,00.html ACT: College Readiness Standards. (2002). Retrieved on July 22, 2009 from http://www.act.org/standard/

Amrein, A. L., & Berlinger, D. C. (2002). High-stakes testing, uncertainty, and student learning. Retrieved June 13, 2005 from http://epaa.asu.edu/epaa/v10n18/

An Agenda for Action. (1980). Retrieved from www.nctm.org/standards/focalpoints.aspx?id=260

Beaton, A. E., & Zwick, R. (1992). Overview of the national assessment of educational progress. *Journal of Educational Statistics, 17*(2), 95-109.

Berry, R. Q. (2003). Mathematics standards, cultural styles, and learning preferences: The plight and the promise of African American students. *The Clearing House, 76*(5), 244-249.

Boaler, J. (2002). Learning from teaching: exploring the relationship between reform curriculum and equity. *Journal for research in mathematics education, 33*(4), 239-258.

Bobbitt, F. (1918). Scientific method in curriculum-making. In F. Bobbitt (Ed.), *The Curriculum* (pp. 41-52). Boston, MA: The Riverside Press.

Bobbitt, F. (1924). Mathematics. In F. Bobbitt (Ed.*), How to make a curriculum* (pp. 158-162). Boston, MA: The Riverside Press.

المنارة للاستشارات

www.manaraa.com

Bobbitt, R. (1926). The fundamental problems of curriculum research. In F. Bobbitt (Ed.), *Curriculum investigators* (pp. 1-6). Chicago, IL: The University of Chicago.

Bosch, C. (2006). Culture and Teaching. Teacher Education Division, Wayne State University, 3.

Bruner, J. (1960). On learning mathematics. *The Mathematics Teacher*, 610-619.

Campbell, P. (1990). So what do we do with the poor, non-white female? Issues of gender, race, and social class in mathematics and equity. *Peabody Journal of Education*, 95-110.

Cobb, P. (1984). Where is the mind? Constructivist and sociocultural perspectives on mathematical development. *Educational Researcher, 23*(7), 13-20.

Cobb, P. (1989). Experiential, cognitive, and anthropological: perspectives in mathematics education. *For the Learning of Mathematics, 9*(2), 32-42.

Curriculum and Evaluation Standards for Mathematics Education. (1989). Retrieved from www.ericdigests.org/pre-9215/evaluation.htm

Darling-Hammond, L. (2004). From "Separate but Equal" to "No Child Left Behind". The Collision of new standards and old inequalities. In A. R. Odden (Ed.), *Many children left behind* (pp. 101-109). Boston, MA: Beacon Press.

Davis, R. B. (1990). Discovery learning and constructivism. In Davis, R. A., Maher, C. A., & Noddings, N. (Eds.), *Constructivist views on the learning and teaching Mathematics* (pp. 93-106). Reston, VA: NCTM.

Dewey, J. (1938). The meaning of purpose. In J. Dewey (ed.), *Experience & Education,* (pp. 67-72). New York, NY., Touchstone Rockefeller Center.

Driscoll, D. (2006). From process to content: standards based reform in Massachusetts. Retrieved from www.pearson.school.com/live/assets/.../2004_01Intro_529_1.pdf

المنارة للاستشارات

www.manaraa.com

Doll, W. (1993). Moderism and post-moderism. In Doll, W. (Ed.), *A post-modern perspective curriculum* (pp. 4-11). New York, NY, Teachers College Press.

Dyer, H. S., & Rosenthal, E. (1974). Assessing education at the State Level: Overview of the Survey Findings. In R. Tyler & R. M. Wolf (eds.), *In crucial issues in testing* (pp. 105-134). Berkeley, CA: McCutchan Publishing Corporation.

Feathers, K. (1993). The basis of content reading. In K. Feathers (ed.), *Infotext reading and learning* (pp. 18-36). Scarborough, Ontario, Pippin Publishing Corporation.

Finley, C. J. (1974). Not just another standardized test. In R. Tyler & R. M. Wolf (Eds.) *In crucial issues in testing* (pp. 95-106). Berkeley, CA: McCutchan Publishing Corporation.

Frawley, W. (1997). Vygotskyan theory: A primer. In W. Frawley (Ed.), *Vygotsky and cognitive science* (pp. 86-105), Cambridge, MA: Harvard University Press.

Finley, C. J. (1974). Not just another standardized test. In R. Tyler & R. M. Wolf (Eds.), *In crucial issues in testing* (pp. 95-106). Berkeley, CA: McCutchan Publishing Corporation.

Frawley, W. (1997). Vygotskyan theory: A primer. In W. Frawley (Ed.), *Vygotsky and cognitive science* (pp. 86-105). Cambridge, MA, Harvard University Press.

Garber, S. (2007). Sputnik and the dawn of the space age. Retrieved November 3, 2009 from http://history.nasa.gov.sputnik/

Gerberich, J. R. (1963). The development of educational testing. Retrieved from http://www.jstor.org/stable/1475207

GLM for Single-Factor, Between-Subjects Designs. (2006). Retrieved from http://web.uccs.edu/lbecker/SPSS/glm_lway.htm

المنارة للاستشارات

www.manaraa.com

Gollnick, D. M. & Chinn, P. C. (1998). Class. In D. M. Gollnick & P. C. Chinn (Eds.), *Multicultural education in a pluralistic society* (pp. 35-73). New Jersey, NJ, Prentice-Hall.

Goodman, N. (1984). *Of mind and other matters*. Cambridge: Harvard University Press.

Gottlieb, D., & Williamson, J. (1967). Understanding children of poverty. Chicago: Science Research Associates, Inc., 39.

Grade Level Content Expectations, Version 12.05. (2006). Michigan Department of Education. Retrieved from http://www.michigan.gov/mde

Grimes, D. A. (2003). *Implementation of the new mathematics curriculum in Ontario: Congruence between students' achievement and teachers' perceptions*. (Doctoral Dissertation, University of New York at Buffalo, 2003), 142-143.

Hamilton, D. (1977). *Making sense of curriculum evaluation: continuities and discontinuities In an educational idea*. Retrieved from http://www.jstor.org/stable/1167178

Hair, J., Black, W., Babin, B., Anderson, R., & Tatham, R. (2006). *Multivariate data analysis* (6th ed.). Upper Saddle River, New Jersey, Pearson Prentice Hall, pp. 383-458.

Harris, K., Marcus, R., McLaren, K., & Fey, J. (2001). Curriculum materials supporting problem-based teaching. *School Science and Mathematics, 101*(6), 310-318.

Hart, L. C. (2002). Preservice teachers' beliefs and practice after participating in an integrated content/methods course. *School Science and Mathematics, 102*(1), 4-14.

Haycock, K., Jerald, C., & Huang, S. (2001). Closing the gap: done in a decade. *The Education Trust*, 3-22.

Hayden, R. (1981). *A history of the "new math" movement in the United States*. Dissertation: Iowa State University, pp. 1-246.

المنارة للاستشارات

www.manaraa.com

Hiebert, J., & Lefevre, P. (1986). Conceptual and procedural knowledge in mathematics: An introductory analysis. In J. Hiebert (Ed.), *Conceptual and procedural knowledge: The case of mathematics* (pp. 1-27). Hillsdale, NJ: Lawrence Erlbaum.

High School Content Expectations, Version 12.05. (2006). Michigan Department of Education. Retrieved from http://www.mighigan.gov/mde

Honigsfeld, A., & Dunn, R. (2009). Learning-style responsive approaches for teaching typically performing and at-risk adolescents. *The Clearinghouse*, *82*(5), 220-224.

Hopkins, D. (1993). A teacher's guide to classroom research. In a D. Hopkins (Ed.), *A teacher's guide to classroom research* (pp. 1-8). Buckingham, MK 18 XW: Open University Press.

Hoy, W. K., Tarter, C. J., & Hoy, A. W. (2006). Academic optimism of schools: A force for student achievement. *American Educational Research Journal, 43*(3), 425-446.

Huntley, M. A. , Rasmussen, C. L., Villarubi, R. S., Santong, J., & Fey, J. T. (2000). Effects of standards based mathematics education: A study of the core-plus mathematics project algebra and functions strand. *Journal for Research in Mathematics Education, 31*(3), 328-361.

Jencks, C., & Phillips, M. (1998). The Black-White test score gap: an introduction. In a C. Jencks & M. Phillips (Eds.), *The Black-White test score gap* (pp. 1-51). Harrisonburg, VA: R. R. Donnelly & Sons.

Jennings, J., & Rentner, D. S. (2006). Ten big effects of the no child left behind act on public schools. *Phi Delta Kappan,* 110-113.

Johnson, E. J. (1992). The design of the national assessment of educational progress. *Journal of Educational Measurement, 29*(2), 95-110.

المنارة للاستشارات

www.manaraa.com

Jones, C. (2005). *An evaluative study of the impact of the "Curriculum Alignment Toolbox" on the middle school science achievement*. Dissertation: Wayne State University: Detroit.

Kahlenbert, R. (2002). Benefits of socio-economic diversity in public schools. Retrieved July 30, 2009 from www.guilford.k12.nc.us/...attachd_socio_economic-diversity.pdf

Kiviat, B. (2001). The social side of schooling. Retrieved July 30, 2009 from http://www.jhu.edu/jhumag/0400web/18.html

Knapp, M., Shields, P., & Turnbull, B. (1995). Academic challenge in high-poverty classrooms. *Phi Delta Kappan, 770-775.*

Kohr, R. L., Coldiron, J. R., Skiffinton, E. W., Masters, J. R., & Blust, R. S. (1988). The relationship of race, class, and gender with mathematics achievement for fifth-, eighth-, eleventh-grade students in Pennsylvania schools. *Peabody Journal of Education, 75*(2), 147-170.

Ladson-Billings, G. (1994). *The dreamkeepers*. San Francisco, CA, Jossey-Bass Publishers, 1-159.

Ladson-Billings, G. (1994). What we can learn from multicultural education research. *Educational Leadership, 51*(8), 22-26.

Lappan, G. (1997). The challenges of implementation: supporting teacher. *American Journal of Education, 106*(1), 207-239.

Launius, R. D. (2005). Retrieved on November 3, 2009 from http://history.nasa.gov/sputnik/sputorig.html

Linn, R. L. (2000). Assessments and accountability. *Educational Researcher, 29*(4), 4-16.

Lubienski, S. T. (2000). A clash of social class cultures? Students' experiences in a discussion-intensive seventh-grade mathematics classroom. *The Elementary School Journal, 100*(4), 377-404.

المنارة للاستشارات

www.manaraa.com

Lubienski, S. T. (2000). Problem solving as a means toward mathematics for all an exploratory look through a class lens. *Journal for Research in Mathematics Research Online, 31*(4P), 454-482.

Lubienski, S. T. (2002). A closer look at black-white mathematics gaps: intersections of race and SES in NAEP achievement and instructional practices data. *The Journal of Negro Education, 71*(4), 269-287.

Lubienski, S. T., & Lubienski, C. (2006). School sector and academic achievement: A multilevel analysis of NAEP mathematics data. *American Educational Research Journal, 43*(4), 651-698.

Lubienski, S. T., & Otto, A. D. (2004). Preparing K-8 teachers in a content course for standards-based mathematics pedagogy. *School Science and Mathematics, 104*(7), 336-350.

Massachusetts Benchmark Standards. (2002). Retrieved from http://www.nesinc.com/PDFS/2004

Malloy, C. (2003). The new math. *Principal Leadership, 3*(7), 48-53.

McGraw, R., Lubienski, S. T., & Struchens, M. E. (2006). A closer look at gender in NAEP mathematics achievement and affect data: Intersections with achievement, race/ethnicity, and socioeconomic status. *Journal for Research in Mathematics Education, 37*(2), 129-150.

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.

Means, B., & Knapp, M. S. (1991). Cognitive approaches to teaching advanced skills to educationally disadvantaged students. *Phi Delta Kappan, 73*, 282-289.

المنارة للاستشارات
www.manaraa.com

Michigan Curriculum Framework. (1996). Retrieved June 26 from www.michigan.gov/mde/0,1607,7-140-28753_38684_28759---,00.html

Michigan Education Report. (2005). Momentum builds for tougher curriculum.

Michigan Department of Education. (2007). Retrieved from http://www.michigan.gov/mde/0,1607,7-140-37818_34785_17513--,00.html

Michigan Department of Education (2008). Retrieved from http://www.michigan.gov/mde/0,1607,7-140-37818_34785_197760--,00.html

Michigan Merit Exam. (2006). Michigan Department of Education. Retrieved from http://www.michigan.gov/mde.

Moll, L. C. (1990). *Introduction: In Vygotsky and education*. New York, Cambridge University Press, 1-31.

Monahan, R. (1998). The rise of standardized educational testing in the U.S.:A bibliographic overview. Retrieved July 29, 2009 from http://www.torinmonahan.com/papers/testing.pdf

Moussiaux, S., & Norman, J.T. (1997). Constructivist teaching practices: perceptions of teachers and students. Retrieved from www.condor.admin.cuny.edu/…/CONSTRUCTIVIST%20TEACHING%20PRACTICES.htm

National Council of Teachers of Mathematics. (1989). *Curriculum and evaluation standards for school mathematics*. Reston, VA: Author.

National Council of Teachers of Mathematics (1991). *Principles and standards for school mathematics*. Reston, VA: Author.

National Council of Teachers of Mathematics. (2000): *Principles and standards for school mathematics*. Reston, VA: Author.

المنارة للاستشارات

www.manaraa.com

National Research Council. (1989). *Everybody counts: Report to the nation on the future of mathematics education*, Washington, D.C., N: National Academy Press, 1-114

Naugle, J. E. (n.d.). The impact of the sputniks and the first vanguard. Retrieved on November 3, 2009 from http://history.nasa.gov/SP-4215/ch1-2.html

No Child Left Behind. (2001). Center on education policy. Retrieved from http://www.cep-dc.org

Pearce, R. R. (2006). Effects of cultural and social structural factors on the achievement of White and Chinese American students at school transition points. *American Educational Research Journal, 43*(1), 75-101.

Principles & Standards for School Mathematics. (2000). Retrieved January 18, 2009 from http://standards.nctm.org/document/chapter3/rep.htm

Reeves, D. B. (2003). High performance in high poverty schools: 90/90/90 and beyond. Retrieved April 4, 2007 from www.sabine.k12.la.us/online/leadershipacademy/high%20performance%2090%2090%2090%20and%20beyond.pdf

Schmidt, W. H., & Prawat, R. S. (2006). Curriculum coherence and national control of education: issue or non-issue? *Journal of Curriculum Studies, 38*(6), 641-658.

Schoen, H. L., Cebulla, K., Finn, K., & Fi, C. (2003). Teacher variables that relates to student achievement when using a standards-based curriculum. *Journal for Research in Mathematics Education, 34*(3), 228-243.

Schoen, H. L., & Hirsch, C. R. (2003). The core-plus mathematics project: perspectives and student achievement. In S. L. Senk, & D. R. Thompson (Eds.), *Standards-based school mathematics curricula: What are they? What do students learn?* (pp.311-343). Mahwah, NJ: Lawrence Erlbaum Associates.

المنارة للاستشارات

www.manaraa.com

Schoenfeld, A. H. (2002). Making mathematics work for all children: issues of standards, testing, and equity. *Educational Researcher, 31*(1), 13-25.

Schwartz, M. (2006). For whom do we write the curriculum? *Journal of Curriculum Studies, 38*(4), 449-457.

Senk, S. L., & Thompson, D. R. (2003). School mathematics curricula: recommendations and issues. In S. L. Senk & D. R. Thompson (eds.), *Standards-based school mathematics curricula: what are they? What do students learn?* (pp. 3-27). Mahwah, NJ: Lawrence Erlbaum Associates, Publishers.

Simon, M. A. & Tzur, R. (1999). Explicating the teacher's perspective from the researchers' perspective: generating accounts of mathematics teachers' practice. *Journal for Research in Mathematics Education, 30*(3), 252-264.

Singapore-Benchmark-Standards.(2001). Retrieved from http://www.moe.gov.sg(press)/2004

Skemp, R. R. (1987). Relational understanding and instrumental understanding. In Skemp, R. R., *The psychology of learning mathematics.* Hillsdale, NJ: Lawrence Erlbaum.

Smith, Y. (2008). Sputnik I. Retrieved on November 3, 2009 from http://www.nasa.gov/multimedia/imagegallery/image_feature_924.html

Spielman, L. J., & Lloyd, G. M. (2004). The impact of enacted mathematics curriculum models on prospective elementary teachers' course perceptions and beliefs. *School Science and Mathematics, 104*(1), 32-44.

Stakes, R. E. (1967). Toward a technology for the evaluation of educational programs. In perspectives of curriculum evaluation. AERA, Rand McNally & Company, 1-12.

Stinson, D. W. (2006). African American male adolescents, schooling (and mathematics): deficiency, rejection, and achievement. *Review of Educational Research, 76*(4), 477-506.

المنارة للاستشارات

www.manaraa.com

Third International Mathematics and Science Study (TIMSS). (1999). Highlights from the TIMSS 1999 video study of eighth-grade mathematics teaching. Retrieved from NCES website: http://nces.ed.gov/timss, pp. 1-12

Third International Mathematics and Science Study-Repeat (TIMSS-R). (1999). Retrieved from NCES website: http://nces.ed.gov/timss/timss-r

Thomas, J. Y., & Brady, K. P. (2005). The elementary and secondary education at 40: Equity, accountability, and the evolving federal role in public education. *Review of Research in Education*, *29*, 51-67.

Thompson, D. R., & Senk, S. L. (2003). High school mathematics curriculum reform. In S. L. Senk & D. R. Thompson (eds.), *Standards-based school mathematics curricula: what are they? what do students learn?* (pp. 299-310). Mahwah, NJ, Lawrence Erlbaum Associates, Publishers.

Thompson, G. (2004) Why do African American students need a culturally relevant education? In a G. Thompson (Ed.), *Through ebony eyes (*pp. 189-208). San Francisco, CA: John Wiley & Sons, Inc.

Thompson, G., Warren, S., & Carter, L. (2004). It's not my fault: predicting high school teachers who blame parents and students for students' low achievement. *The High School Journal*, 87(3), 5-14.

Tyler, R. (1947). The organization of learning experiences. In V. E. Herrick & R. Tyler (eds.), *Toward improved curriculum theory* (pp. 59). Chicago, IL: The University of Chicago Press.

Tyler, R. (1949). What educational purposes should the school seek to attain? In R. Tyler (ed.), *Basic principles of curriculum and instruction* (pp. 1-43), Chicago, IL: The University of Chicago Press.

المنارة للاستشارات

www.manaraa.com

Tyler, R. (1966). The objectives and plans for a national assessment of educational progress. *Journal of Educational Measurement*, 3(1), 1-4.

Tyler, R. (1967). Changing concepts of educational evaluation. In R. Tyler (Ed.), *Perspectives of curriculum evaluation* (pp. 13-18). Chicago, IL: Rand McNally & Company.

Tyler, R. (1974). A perspective on the issues. In R. Tyler & R. M. Wolf (eds.), *Crucial issues in testing* (pp. 1-10). Berkeley, CA: McCutchan Publishing Corporation.

Tyler, R. (1974). Assessing education on the national level. In R. Tyler & R. M. Wolf (eds.), *Crucial issues in testing* (91-95). Berkeley, CA: McCutchan Publishing Corporation.

United States Department of Education. (2002). *No child left behind: A desktop reference 2002*. Washington, D.C.: U.S. Department of Education, Office of Elementary and Secondary Education.

Vandell, D. L., Reisner, E. R., & Pierce, K. M. (2007). Outcomes linked to high-quality afterschool programs: longitudinal findings from the study of promising afterschool programs. Retrieved November 16, 2009 from http://www.policystudies.com

Van De Walle, J. (2006). *Elementary and middle school mathematics.* 6th ed. Boston: Pearson

Villegas-Reimers, E. (2003). Teacher professional development: an international review of the literature. Retrieved from www.unesco.org/iiep

Walmsley, A. L. E. (2001). *A history of the "new mathematics" movement and its relationship with the national council of teachers of mathematics standards*. Dissertation: Saint Louis University, 1-188.

White, W. (1958) Sputnik and its satellites. Retrieved on November 3, 2009 from http://www.jstor.org/stable/453193

Yaffe, D., Coley, R. J., & Pliskin, R. (2009). Addressing achievement gaps. *Educational Testing Service*, *17*(1), 1-12.

المنارة للاستشارات

www.manaraa.com

Zimmerman, R. S., Khoury, E. L., Vega, W. A., & Warheit, G. J. (1995). Teacher and parent perceptions of behavior problems among a sample of African American, Hispanic, non-Hispanic White students. *American Journal of Community psychology. 23*(2), 181-197.

المنارة للاستشارات

www.manaraa.com

ABSTRACT

THE RELATIONSHIP BETWEEN
CORE-PLUS MATHEMATICS PROJECT AND STUDENT ACHIEVEMENT

by

KAREN R. TREADWAY-HARVEL

December 2010

Advisor: Dr. Thomas Edwards

Major: Curriculum and Instruction (Mathematics Education)

Degree: Doctor of Philosophy

The Third International Mathematics and Science Study (TIMSS) study revealed that test scores from high school students were below average in mathematics and science. Studies show that part of it stem from the traditional methods of teaching rather than the standards based teaching. According to the No Child Left Behind (NCLB) act, students should receive a rigorous and relevant curriculum. The High School Content Expectations (HSCE) is a set of objectives that meet this criteria but the current curriculum still uses traditionally-based curriculum. More than 80% of textbooks located in schools today are traditionally-based. Moreover, teachers who are teaching have been educated by traditional instructors. Therefore, they teach students the way they have been taught. To change mathematics education, educators should consider looking at the way mathematics is taught and look at activities students are involved in during instruction.

This study focused on the effective use of the Core-Plus Mathematics Project (CPMP) that resulted in an increase in academic achievement. Students' perceptions on the use of the CPMP were a focus of the study. Finally, differences in procedural and conceptual knowledge between genders in both groups were examined. The control group received the traditional textbook and the treatment group received the traditional textbook along with the CPMP. The

المنارة للاستشارات
www.manaraa.com

results of the study found no significant difference procedurally between the two groups. However, the treatment group did significantly better using the CPMP curriculum than the control group. The study also showed that although the treatment group had negative perceptions about using the CPMP curriculum, they did better than the control group. Results of the study showed that although the females did better procedurally and conceptually than males, the differences were not statistically significant.

A relationship was found between the use of the CPMP curriculum and students' mathematics achievement. CPMP provided students with a rigorous, conceptually-rich instruction that was based on the benchmarks required from the HSCE objectives that was derived from the national standards.

المنارة للاستشارات
www.manaraa.com

AUTOBIOGRAPHICAL STATEMENT

Karen R. Treadway-Harvel

Education	Ph.D., Wayne State University-Curriculum and Instruction (Mathematics Education)-December 2010 Masters Degree in Teaching-Major: Secondary Education-Mathematics-Wayne State University-May 2002 Bachelors of Arts Degree: Major: Mathematics, Minor: Social Studies-December 1990
Teaching Credentials	State of Michigan Professional Certificate: Mathematics and Social Studies
Teaching Awards	Wayne RESA'S Outstanding High School Teacher of the Year, 2003-04 Dean's Scholarship for Elementary or Secondary Mathematics/Science Education- May 2007 J. Wilmer Menge Memorial Scholarship, May 2008 Dean's Scholarship, May 2009
Professional Experience	Detroit Public Schools, Mathematics Teacher-1997-present Lead Teacher-Curricular Alignment and Monitoring Mathematics, 2005-2009 Crosman Alternative High, John J. Pershing High, and Renaissance High Standardized Testing Assistant Coordinator: MEAP, MME, MIP, Terra Nova: Crosman Alternative High-January 2006-June 2007; John J. Pershing High-September 2007-June 2008 Attendance and Grading Committee-Chairperson: Crosman Alternative High-September 2006-June 2007 School Improvement Planning Committee Member: Crosman Alternative High-2004-2007 Adjunct Faculty Member-Mathematics-Oakland Community College-May 2007-present Adjunct Faculty Member (Mentoring)-Mathematics- University of Phoenix-July 2010-present United States Postal Service-Carrier-1985-1993 United States Postal Service-Supervisor-1990-1998
Professional Memberships	Detroit Area Council of Teachers of Mathematics Michigan Area Council of Teachers of Mathematics National Council for the Social Studies

المنارة للاستشارات
www.manaraa.com