COOPERATIVE LEARNING AND THE GIFTED STUDENT IN ELEMENTARY MATHEMATICS

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Cooperative Learning and the Gifted Student in the Elementary Classroom

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Abstract

Christine C. Hecox. COOPERATIVE LEARNING AND THE GIFTED STUDENT IN ELEMENTARY MATHEMATICS. (Under the direction of Dr. Scott Watson) School of Education, 2010.

The research was a quantitative research project dealing with Florida Comprehensive Assessment Test (FCAT) Mathematics scores of fourth grade students, including gifted and high-achieving students, in 2008-2009 under the exposure of daily cooperative learning in mathematics. The problem statement was as follows: In Polk County, Florida, how does cooperative learning affect the FCAT Mathematics scores among fourth grade students, including gifted and high-achieving students? The purpose of the quasi-experimental study was to explore the relationship of cooperative learning versus traditional learning on their student achievement. The null hypothesis was that cooperative learning would have no effect on fourth grade gifted Mathematics FCAT scores at an experimental school in Polk County, Florida. The findings demonstrated that there was no difference in fourth grade FCAT Mathematics scores between students who participated in cooperative learning versus traditional learning. In addition, there was no difference in fourth grade gifted and high-achieving students' FCAT Mathematics scores who participated in cooperative learning on a daily basis in mathematics instruction versus fourth grade gifted and high achieving students' FCAT Mathematics scores who participated in traditional learning on a daily basis in mathematics instruction. Suggestions for further research were included.

Dedication

First of all, I would like to dedicate this research project to God who guided me through every step of the way. He was there for all the stressors, tears, sweat, and joy. Without His presence and guidance through the Scriptures (II Timothy 3:16), this project would be in vain.

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List of Tables

Page

Table 1: Descriptive Statistics for Three Learning Preferences……..…47

Table 2: Results of Murie Study…….53

Table 3: Results of Dotson Study……...55

Table 4: Demographics of All Fourth Grade Subjects……73

Table 5: 3rd Grade FCAT Math Scores of All Fourth Grade Students……...74

Table 6: Demographics of Fourth Grade Gifted and High-Achieving Students……75

Table 7: 3rd Grade FCAT Math Scores of Gifted Students……..…..….76

Table 8: Levene's Test of Equality of Error Variances for All Fourth Grade Scores....77

Table 9: Results of ANCOVA for all Fourth Grade Students FCAT Math Scores…....78

Table 10: Leven's Test of Equality of Error Variances for Gifted Students…….....79

Table 11: Results of ANCOVA for Gifted Students 4th Grade FCAT Math scores.....80

Table of Contents

Page

Abstract……...iii

Dedication..……..……iv

Acknowledgements..……v

List of Tables…..……vi

Table of Contents…….viii

CHAPTER ONE: INTRODUCTION……1

Background of the Study.....2

Theoretical Context…….2

Societal Context.....3

Historical Context……5

Educational Context……7

Nation at Risk……..7

State at Risk…….8

Emphasis on Academic Achievement…….8

Problem Statement…….……10

Purpose of the Study……...…10

Statement of the Problem…….……..10

Research Question One……..10

Research Question Two…….……10

Statement of Hypothesis……..…….….11

Definition of Terms……11

CHAPTER TWO: REVIEW OF RELATED LITERATURE…….15

Theoretical Background…….15

Social Interdependence Theory……..15

Cognitive Theory……..…….17

Cognitive-developmental Theory……..17

Cognitive-elaboration Theory……18

Behavioral Learning Theory……..18

Theoretical Application…….19

Brain-Based Learning……19

Definition of Brain Based Learning.……...……19

Impact of Brain Based Learning in the Classroom……20

Cooperative Learning…….22

Traditional versus Cooperative Learning.……...…22

Traditional Learning.……..22

Cooperative Learning.……..…..……..23

Types of Cooperative Learning Methods……..24

Comparison of Cooperative Learning Methods……26

Kagan Cooperative Learning Method……...27

Considerations during Cooperative Learning……....30

Type of Learning Environment……..30

Heterogeneous versus Homogeneous Environment……..30

Self-contained versus Inclusive Settings…….……..….31

Teacher's Role in Cooperative Learning……...32

Cooperative Learning and Mathematics……36

Gifted Students and Their Learning…….…..40

Related Research……44

Summary……57

CHAPTER THREE: METHODOLOGY…….58

Design of the Study……58

Statement of the Problem……...59

Statement of Hypothesis……60

Research Context……...……60

School Demographic Context……....61

Gifted Program Context…….62

Math Research Context……..…62

Research Participants…….63

Student Participants……...63

Teacher Participants……...64

Instrumentation, Validity, and Reliability…….65

Instrument…….…….65

Instrument Scoring…….……67

Instrument Validity……68

Instrument Reliability……69

Data Collection and Procedures…….70

Data Analysis……...…..70

Analysis Instrument……...71

First Hypothesis Analysis……..……71

Second Hypothesis Analysis……..……71

CHAPTER FOUR: STATISTICS AND FINDINGS…….....72

Descriptive Statistics……..73

Treatment and Control Group Descriptive Statistics…….……73

Demographics of All Fourth Graders……73

Learning Ability of All Fourth Graders…….74

High Achieving and Gifted Students Descriptive Statistics.…….74

Demographics of Gifted and High-Achieving Fourth Graders…..……75

Learning Ability of Gifted and High-Achieving Fourth Graders……..75

Research Results……...…….76

Results for All Fourth Grade Students……...…76

Type of Statistics……76

Results of the ANCOVA……...76

Results for Gifted and High-Achieving Students……..78

Type of Statistics……79

Results of the ANCOVA……...79

CHAPTER FIVE: SUMMARY, CONCLUSIONS, & RECOMMENDATIONS……..81

Summary……81

Review of Statement of the Problem…….81

Review of the Hypothesis……..81

Review of Methodology……82

Summary of Results……...……83

Hypothesis One……..…83

Statement of Problem…….84

Statement of Hypothesis……84

Hypothesis Two…….84

Statement of Problem Two ……...85

Statement of Hypothesis Two……85

Discussion……..86

Comparison of Results to Other Studies……86

Limitations to the Study…….92

Conclusions……...……..94

Implications……98

Recommendations for Future Research……...……102

References……104

Appendix A……..112

Appendix B……..……114

Appendix C……..115

Appendix D……..116

Appendix E……..117

Appendix F……..118

Chapter One: Introduction

The Department of Education's report (1983), A Nation at Risk, stipulated that all children regardless of race, class, or economic status are entitled to opportunities and tools to be successful in school. However, the same report (1983) found that our nation's education system desperately needed reform. Reform involved a standards-based education with achievement testing. Later, President George W. Bush signed into law the *No Child Left Behind Act* of 2001. The law mandated that the Department of Education keep schools across the nation accountable for teaching the states' standards and maintaining appropriate achievement test scores for all students (Jorgensen and Hoffmann, 2003). Therefore, school districts across America needed to find best teaching practices that would cover the state standards and generate high test scores (Thompson, 2008). One of the best teaching practices teachers were using in the classroom was cooperative learning (Slavin, 1995). Cooperative learning appeared as early as the first century (Slavin, 1995). A common practice of American one room school houses involved peer tutoring, a form of cooperative pairs (Johnson and Johnson, 1999). However, in the present education realm, there is a debate of whether or not cooperative learning benefits everyone (Huss, 2006). Proponents of cooperative learning such as Spencer Kagan (2000) claim that the implementation of cooperative learning in the classroom positively affects all students, regardless of learning style or ability. For example, an educator, Jeanie Dotson (2001), demonstrates in a study that Kagan Cooperative Learning Structures increased student achievement in her eighth-grade social studies classroom. In addition, other proponents of cooperative learning such as Johnson,

Johnson, and Stanne (2000), state that other types of cooperative learning methods demonstrate an increase in student achievement. Many studies have demonstrated that students who learn in cooperative learning groups learn more than students who learn in traditional programs (Slavin, 1987). However, critics of cooperative learning such as the National Association for Gifted Students (2006) argue that cooperative learning is not always beneficial for gifted and high-achieving students. The National Association for Gifted Students (2006) would like more studies to be completed on the effectiveness of cooperative learning on the gifted students before theorists and educators make claims that cooperative learning is for everyone.

This particular study examined the implementation of cooperative learning to fourth grade students, including gifted and high-achieving students, in mathematics. The author of the study utilized quantitative measurements to compare the state standardized mathematics test scores of the treatment and control groups. In addition, the researcher examined fourth grade gifted and high-achieving state standardized test scores after exposure to cooperative learning. The purpose of this study was to examine traditional learning versus cooperative learning in mathematics among all fourth grade students. The specific cooperative learning method was Kagan Cooperative Structures. The intended outcome of this investigation was to determine whether or not cooperative learning is effective for all students, including gifted and high-achieving students, in mathematics.

Background of the Study

Theoretical Context

According to John Donne (1624) in one of his famous meditations, no man is an island, entire of itself. His statement implies that people are connected spiritually, emotionally, and physically. Man cannot live in life without successfully connecting to people. In the Word of God, Genesis 2.18 (NKJV, 1999) states that God declared that it was not good for man to live alone. Therefore, God created Eve to be a companion for Adam. Our Heavenly Father understood the importance of companionship and socialization.

In addition, theorists such as Vygotsky (1978) states in his theoretical framework that social interaction plays a vital role in cognitive development. He claims that children first learn on a social level, and then children later reflect upon the learning on an individual level. Vygotsky claims this theory applies to a person's voluntary attention, logical memory, and the formation of concepts. Basically, his social learning principle states that full cognitive development requires social interaction.

Societal Context

Johnson and Johnson (1999) declared:

> A social support system consists of significant others who collaboratively share a person's tasks and goals and provide resources (such as emotional concern, instrumental, aid, information, and feedback) that enhance the individual's well-being and help the individual mobilize his or her resources to deal with challenging and stressful situations. (Johnson & Johnson, 1999, p. 64)

Johnson and Johnson (1999) stated that schools do not adequately provide social support systems for children, because schools concentrate too much on competitive and individualistic type learning. Therefore, self-interest is more predominate in American society, and young adults have a lack of commitment to community, country, or God (Johnson & Johnson, 1999). The consequences of schools not having a social support system involve a lack of one's purpose for life, self-destructiveness, lack of foundation, loneliness, and alienation (Conger, 1988). Klinger (1977) claims that a life of meaning involves feeling loved and wanted by others. Therefore, Johnson and Johnson (1999, p. 66) demanded that schools provide social support systems and structure these systems to follow these researched principles:

1. Focus the efforts on having students within small groups persuade each other to value education.
2. Permit small group discussions that lead to public commitment to work harder and take education more seriously.
3. Build committed and caring relationships between academically oriented and non-academically oriented students.
4. Personally tailor appeals to value education to the student.
5. Plan for long-term conversions. It will take years for internalization.
6. Remind students they can't do it alone, but need help from their friends.

Historical Context

In the past, educators understood that students could learn from other students in a one room schoolhouse of multi-ages. Peer teaching was a common practice in history. During the time period of the one-room schoolhouse, the teacher had to meet the challenge of teaching children of various ages (Smith & MacGregor, 1992). The older or more advanced students ended up peer teaching the younger or below average students. According to Topping (2005), the assumption was that peer helpers should be the older or better student. However, in recent decades, educators have realized that the vast difference in age, interest, and ability did not benefit the peer teacher (Fore, Riser, & Boon, 2006). Therefore, researchers such as Piaget, Vygotsky, and Carroll believed appropriate and adequate peer interaction should promote learning between all individuals (Fore, Riser, & Boon, 2006). Therefore, individuals began theorizing, researching, and studying more about cooperative learning.

Theorists began formulating explanations of why cooperative learning works. According to Johnson and Johnson (1999), the social-interdependence theory, cognitive theories, and behavior learning theory explain why educators should expose students to cooperative learning. The researchers claim that cooperative learning will never go away due to its rich history, research, and actual implementation in the classroom. From the 1960s to the present time, researchers have developed and evaluated specific cooperative learning methods and strategies (see Appendix A). According to Sharan (1990), there have been eight methods of cooperative learning that have evolved or remained:

1. Johnson and Johnson's Learning Together and Alone and Constructive Controversy

2. Devries and Edwards' Teams-Games-Tournaments
3. Sharan and Sharan's Group Investigation
4. Aronson's Jigsaw
5. Slavin's Student Teams Achievement
6. Team Accelerated Instruction
7. Cooperative Integrated Reading and Composition
8. Kagan's Cooperative Learning Strategies.

Regardless of the type of cooperative learning method, educators promote Slavin's (2006) current definition of peer-assisted learning, or cooperative learning as "working together in small groups to help each other learn" (p. 255). Slavin's six principles of cooperative learning help educators identify cooperative learning methods over group work (Slavin, 1995). Cooperative methods must include group goals, individual accountability, equal opportunity for success, team competition, task specialization, and adaptations to individual needs (Slavin, 1995, p. 12). However, many teachers' attempts to implement cooperative activities fail due to group conflicts such as taking over or fighting over jobs. The consequence of negative interdependence is competition, and competition obstructs each team member's efforts to achieve (Johnson & Johnson, 1999).Therefore, educators now understand that considerations must be made for cooperative activities. According to Kagan (2000), educators are now implementing cooperative group structures that promote every student having a role and responsibility, and those students must be accountable for their jobs.

Therefore, researchers and educators are seeking to find effective ways to manage and implement cooperative learning within the classrooms to promote meaningful learning and social interaction between peers.

Educational Context

Nation at risk. Vygotsky's theory of social learning has influenced classrooms across the nation; however, our nation is also concerned about academic achievement. In 1981, the National Commission on Excellence in Education examined the data and literature on the quality of learning and teaching in the nation's public and private schools, colleges, and universities. The committee synthesized its findings in a report titled, A Nation at Risk. According to Jorgensen and Hoffman (2003, p. 2), the report indicated:

1. About 13% of all 17-year olds were illiterate. Literacy among the minority population was as high as 40%.
2. The SAT scores declined in verbal, mathematics, physics, and English subjects.
3. Nearly 40% of 17-year olds could not infer from written material.
4. One third of 17-year olds could write a persuasive essay or solve a multi-step mathematics problem.
5. Remedial mathematics courses increased by 72%.

According to Jorgensen & Hoffman (2003, p. 3) the report stated that the causes of the decline in the nation's education were the results of:

1. School content was diluted and without purpose.
2. There were deficiencies in expectations of students.

3. Students spent less time on study skills, and there was not enough time in the school day to complete work.
4. The field of teaching was not attracting academically able students, and teacher preparation programs needed to make improvements.

After the Nation at Risk report, the movement towards standards-based education and assessment swept across the nation. Later, President George Bush signed into law the No Child Left Behind Act of 2001.

State at risk. In the state of Florida, the No Child Left Behind Act of 2001 impacted the way Florida educators taught curriculum and assessed whether or not students learned the curriculum (Florida Department of Education, 2005). Florida implemented the Sunshine State Standards. These standards dictated what teachers taught at every grade level in every subject, with an attempt to provide consistency in learning across the state. In addition, the Florida Department of Education created the Florida Comprehensive Assessment Test (FCAT) in a variety of subjects to measure whether or not students learned the Sunshine State Standards.

Regardless of the state, the No Child Left Behind Act of 2001 states that any school's success is based on student achievement measured by standardized test scores; consequently, student achievement has become a primary focus of schools in our nation. There is an educational emphasis on academic achievement; consequently, school districts across the nation are researching ways to raise student test scores.

Emphasis on academic achievement. Now, scientists explore how people can collaborate and learn from one another, and educators implement cooperative strategies within the classroom to increase student achievement (Johnson, Johnson, & Smith, 1991).

Researchers continue to study the brain, conduct field experiments, and reflect upon the effects of cooperative learning in the classroom (Kagan, 2001). Overall, these researchers have found that some cooperative learning methods raise student achievement for various students (Johnson, Johnson, & Stanne, 2000). However, does cooperative learning work for everyone?

According to researchers, cooperative learning has a positive effect. For example, Johnson, Johnson, and Stanne (2000) demonstrate through their meta-analysis of various cooperative learning methods that cooperative learning methods have a positive effect on student achievement. In addition, researchers, such as Slavin (1995), state cooperative learning motivates students to learn. Sharan (1990) claims cooperative learning promotes a healthy interaction among peers and enhances social skills. Also, Spencer Kagan (2004) declares that cooperative learning benefits all students regardless of age, race, family background, learning styles, and ability. However, the National Association for gifted students (2006) declares that cooperative learning is not beneficial for all students. There are a lot of studies that demonstrate the exposure of cooperative learning increases student achievement among lower achieving students, but there are not a lot of current experimental studies that demonstrate whether or not the exposure of cooperative learning affects the gifted and high-achieving student. Proponents for gifted students believe that cooperative learning does not benefit gifted children (Brand, Lange, and Winebrenner, 2004). According to the National Association for Gifted Children (2006), cooperative learning may not meet gifted students' needs if the cooperative task is not differentiated for the students. VanTassel-Baska, Landra, & Peterson (1992) state that researchers need to study more the effects of cooperative learning on the gifted

population before deciding whether or not cooperative learning is effective or non-effective for these students.

Problem Statement

Purpose of the Study

The purpose of this study was to explore the relationship of cooperative learning among all students, including the gifted and high-achieving population, to their student achievement through quasi-experimental research. Educators are influenced with promises of increased standardized test scores by many researchers, creators of cooperative learning methods, and school districts; however, educators are responsible for critically examining whether or not cooperative learning works for everyone. What works for one classroom may not work for another classroom, because every class is filled with students from different backgrounds, learning abilities and learning styles. In addition, the researcher chose the area of mathematics, because mathematics is an objective subject area in the areas of curriculum, instruction, and assessment.

Statement of the Problem

The statement of the problem centered around two research questions:

Research question one. At the experimental school, how does the implementation of cooperative learning affect the Florida Comprehensive Assessment Test (FCAT) mathematics scores among all fourth grade students?

Research question two. At the experimental school, how does the implementation of cooperative learning affect the Florida Comprehensive Assessment Test (FCAT) mathematics scores among fourth grade gifted and high-achieving students as compared to traditional learning?

Statement of Hypothesis

The hypotheses were as follows:

H_{0a}: There will be no significant difference in Florida Comprehensive Assessment Test (FCAT) Math scores of fourth graders who participated in cooperative learning on a daily basis in mathematics as compared to Florida Comprehensive Assessment Test (FCAT) Math scores of fourth graders who participated in traditional learning on a daily basis in mathematics.

H_{0b}: There will be no significant difference in Florida Comprehensive Assessment Test (FCAT) Math scores of fourth grade gifted and high-achieving students who participated in cooperative learning on a daily basis in mathematics as compared to Florida Comprehensive Assessment Test (FCAT) Math scores of fourth grade gifted and high-achieving students who participated in traditional learning on a daily basis in mathematics.

Definition of Terms

The researcher has provided the following definitions in order to ensure understanding of the research.

Cooperative Activities – structured activities that involve all students by providing everyone with a role and responsibility

Cooperative Learning – working together in small groups to help each other learn or accomplish a task (Slavin, 2006)

Cooperative Lessons – lessons that integrated a cooperative learning method

Cooperative Methods – way of implementing cooperative learning in the classroom

Differentiated Instruction – instruction that is different for each child; based on the child's individual needs

Elementary School – in this case, elementary school includes kindergarten through fifth grade

Exceptional Student Education – learning that involves students with handicaps, learning disabilities, or learning exceptionalities

Equal Participation – each member of a cooperative team is afforded equal shares of responsibility and input (Dotson, 2001)

Fourth Grade Student – a student in the fourth grade may be seven through 11 years old, depending on birthday and retention

Florida Comprehensive Assessment Test (FCAT*)* - part of Florida's overall plan to increase student achievement by implementing higher standards; administered to students in Grades 3-11, consists of criterion-referenced tests in mathematics, reading, science, and writing, which measure student progress toward meeting the Sunshine State Standards (SSS) benchmarks (Florida Department of Education, 2008)

Gifted Student – students who have superior intellectual ability, advanced mental ability and are capable of high performance; ability levels of gifted students rank in the top 3-5% of the population (Polk County School District, 2007)

Heterogeneous – a mixed ability group of students

High Achieving Student – for the purposes of this project, a high achieving student is a student who previously scored a Level 4 or 5 (2 levels above average) on a previous standardized test

Homogeneous – same ability group of students

Inclusion – all students, regardless of ability, are part of a classroom community

Individual Accountability – students are held accountable for doing a share of the work and for mastery of the material (Dotson, 2001)

Kagan Cooperative Learning Method – created by Dr. Spencer Kagan; involves Kagan Cooperative Structures that are useful for any subject area

Kagan Cooperative Structures – cooperative learning structures created by Spencer Kagan (Kagan, 2000)

Learning Ability – capacity and intelligence to learn

Learning Style – methods that attract a person to learn and retain information

Lesson Plans – detailed daily plans that describe the objectives, materials necessary, procedures, and assessment for the day's lesson

Low Achieving Student – for the purposes of this project, a low achieving student is a student who previously scored a Level 1 or 2 (1-2 levels below average) on a previous standardized test

Mathematics (Math) – the time that the subject of mathematics is taught by the teacher; may include calendar time, direct instruction, guided learning, cooperative activities, independent work, small group remediation, centers, and/or tests

Positive Interdependence – occurs when gains of individuals or teams are

correlated (Dotson, 2001)

Scale Score – ranging from 100 to 500; used to determine a student's achievement Level (Florida Department of Education, 2008)

Simultaneous Interaction – class time is designed to allow many student interactions during the period (Dotson, 2001)

Chapter Two: Review of Related Literature

People can work competitively, individualistically, or cooperatively. According to Johnson and Johnson (1999), humans need to learn how to balance all three. When educators choose one type of work method over another, then the results can be a disaster. For example, competition may facilitate students to give up, because the low-achieving students recognize there is only one winner (Johnson & Johnson, 1999). In addition, individualism alone may ignore the success and failures of others. Cooperative learning can also fail if teachers do not use the proper method (Slavin, 1995). Therefore, educators should structure cooperative learning goals to promote competitive, individualistic, and cooperative efforts while making careful considerations such as what cooperative learning method to utilize within the classroom. Kagan (2000) states his cooperative learning method in the classroom can balance competitive, individualistic, and cooperative efforts for all students, regardless of learning ability or style.

Theoretical Background

There are three major theories that guide and improve the practice of cooperative learning (Slavin, 1995, p. 16):

1. social interdependence theory
2. cognitive-development theory
3. behavioral learning theory.

These theories form a foundation for the practice of cooperative learning in the classroom.

Social Interdependence Theory

According to Johnson and Johnson (1975), the most influential theory is the social interdependence theory. In the 1900s, Kurt Koffka introduced the concept that group members were interdependent as a dynamic whole. Many of Koffka's follower's refine his proposal into theory. First, Lewin (1935) stated that common goals facilitate a group to be interdependent; therefore, a group becomes a dynamic whole, meaning a member of the group can change the dynamics of the group. In addition, Lewin (1935) believed an intrinsic state of tension motivated students to accomplish the group's goals. Next, Lewin's graduate student, Deutsch (1962), expanded on Lewin's theory by stating that interdependence could be positive or negative. Positive interdependence promoted cooperation while negative interdependence promoted competition. Slavin (1995) claimed competition is "rarely healthy or effective." He stated that competition is a poor motivator for low achievers. If success depends on competition, low achievers easily give up in the contest. In addition, Slavin (1995) believed that high achievers end up accepting mediocrity in competitive situations, because the peer group's norm, especially at high school age, is to not succeed in competitive situations. He stated that high school students view winners as teacher's pets. After Deutsch refined Lewin's theory of social interdependence, Johnson and Johnson (1989) formulated the current theory of social interdependence. These researchers stated:

> Social interdependence theory posits that the way social interdependence is structured determines how individuals interact which, in turn, determines outcomes. Positive interdependence (cooperation) results in promotive interaction as individuals encourage and facilitate each other's efforts

> to learn. Negative interdependence (competition) typically results in oppositional interaction as individuals discourage and obstruct each other's efforts to achieve.
> (Johnson & Johnson, 1999, p. 187)

Cognitive Theories

Cognitive-developmental theory. According to Johnson and Johnson (1999), the cognitive-developmental theory is based on the theories of Piaget and Vygotsky. Johnson and Johnson (1999) stated that Piaget holds to the premise that cooperation creates cognitive disequilibrium. Cognitive disequilibrium involves conflict that facilitates an individual's growth in perspective-taking ability and cognitive development. Slavin (1995) stated that Piaget believed language, values, rules, morality, and other learning can be learned only in interaction with others. Cooperative learning permits students to interact with one another by forcing the students to reach a consensus with other students who have opposing views (Johnson & Johnson, 1999). In result, students grow intellectually, because they must create a more thoughtful conclusion. According to Johnson & Johnson (1999, p. 39), the key steps to a thoughtful consensus conclusion are:

1. Organize what is known into a position.
2. Advocate that position to someone else who has an opposition position.
3. Attempt to refute the opposing position while rebutting attacks on your own position.
4. Reverse perspectives so that the issue may be seen simultaneously.
5. Create a synthesis to which all sides can agree.

In addition to Piaget's premise that individuals accelerate their intellectual development through cooperative learning, Vygostky (1978) stated cooperative learning enhances children's intellectual growth by working in within one another's proximal zones of development. Zone of proximal development is the zone between what a student can achieve independently and what a student can accomplish while working with an instructor or more capable peers (Johnson & Johnson, 1999). Cooperative learning provides modeling, coaching, and scaffolding for the students; therefore, students learn from each other (Slavin, 1995). Vygostky (1978) declared that teachers should minimize the time for students to work alone.

Cooperative elaboration theory. Theorists who believe in the elaboration theory versus the developmental theory claim that students must engage in some sort of cognitive elaboration of the material in order to retain and apply information learned (Johnson & Johnson, 1999). Examples of cognitive elaboration involve writing a summary or outlining a lecture, because students must comprehend, sort, and reorganize the important information to them. Johnson and Johnson (1999) claimed that the best way to comprehend, sort, and reorganize information is discussing the material with another individual.

Behavioral Learning Theory

Skinner's theory states individuals will work hard on tasks that involve positive reinforcement, and they will fail to work on tasks that provide negative reinforcement (Johnson & Johnson, 1999). In a traditional classroom, students positively reinforce students who do not succeed; because one student's success decreases the odds of other students' success (Johnson & Johnson, 1999). However, according to Slavin (1995),

cooperative learning increases students' chances for success, because the students are collaborating with each other on a common goal. The team members are generally successful if group members help their teammates accomplish the group task. In a cooperative classroom, students tend to encourage and praise their group members. Slavin (1995) finds several studies that demonstrate cooperative learning motivates students to learn and succeed.

Theoretical Application

The social-developmental, cognitive, and behavior learning theories provide "a classical triangulation of validation for cooperative learning (Johnson & Johnson, 1999, p. 188)." Johnson and Johnson (1999) declared that cooperative learning promotes higher academic achievement than individual or competitive learning. For example, these researchers stated that the social-developmental theory demonstrates cooperative learning should facilitate students to work together and achieve a group goal. The students are dependent upon one another. Also, the cognitive theories show students who reflect upon their own learning and share that learning with others should grow more intellectually, because the students must reflect, evaluate, and summarize. In addition, the behavior learning theory demonstrates that a group goal should motivate students to work harder and succeed (Johnson & Johnson, 1999).

Brain Based Learning

Definition of Brain Based Learning

Not only is the triangulation of the social-developmental, cognitive, and behavior learning theories important to the theory of cooperative learning, but also the theory behind brain based learning is key to understanding cooperative learning. During the

1980's, brain based learning emerged into the scene of the biology of learning (Jensen, 1996). Brain based learning involves studying how the brain works and finding ways the brain can work better (Jensen, 1996).

The human brain consists of the brain stem, mid brain area, and the cerebrum area. Each part of these three areas of the brain functions in a different way (Jensen, 1996). The brain stem is responsible for learned behaviors such as social conformity, territoriality, mating rituals, deception, ritualistic display, hierarchies, and social rituals. The midbrain area is responsible for attention and sleep, social bonding, hormones, emotions, discovering truth, memories, expressiveness, and long-term memory. The cerebrum and neo cortex that covers the majority of the brain helps us think, reflect, process, problem-solve, read, write, visualize, compose, translate, and be creative. All three parts work together, and they work better when all parts process at once. Jensen (1996, p. 8) stated, "In fact, it prefers multi-processing so much, a slower, more linear pace actually reduces understanding."

Impact of Based Brain Learning in the Classroom

The brain simultaneously processes color, movement, emotion, shape, intensity, sound, taste, and much more. "This amazing multiprocessor can be starved for input in a traditional learning type of classroom" (Jensen, 1996, p. 8). According to Jensen (1996), classrooms should parallel the global society. Students need to learn the vital skills necessary for teamwork, model-building, problem-solving, and communication to function in the real-world. So, educators should implement a type of learning that is specific to the learner, creates a feeling of being a stake-holder, permits feedback, and provides a sense of accomplishment. Johnson & Johnson (1999) believe that cooperative

learning is specific to the learner by being responsible for a part on the team; creates a feeling of being a stake-holder by helping accomplish a team goal; permits feedback by allowing for opportunities for peer discussion and support; and provides a sense of accomplishment by working together to achieve a common goal.

Also, Fogarty (1997) defined a brain-compatible classroom as a classroom that sets the climate for thinking, teaches the skills of thinking, structures interaction with thinking, and reflects upon the thinking. First, setting up the climate for thinking involves the educator creating a climate that invites learning. Students should be able to explore and investigate with a safety net. According to Slavin (1995), cooperative learning allows students to take risks, because there is no competition. The low achieving students may feel comfortable receiving help from their peers, because all the students are working together to achieve a common goal. Next, teaching the skills of critical thinking involves the educator modeling and guiding students through critical thinking. Also, students should be allowed to practice critical thinking skills through teachers structuring interaction (Fogarty, 1997). According to Piaget (1926), critical thinking is only accessible through interactions with others. Slavin (1995) stated that cooperative learning requires students to think critically by learning and practicing defending their thoughts, beliefs, and positions to their peers. One declares about most students in our nation:

> They do not know how to conduct a serious discussion of their own most fundamental beliefs. Indeed, they do not know in most cases what those beliefs are. They are unable to empathize with the reasoning of those who seriously

disagree with them. (Paul, 1984, p. 12)

According to Jorgensen and Hoffmann (2003), students must be able to learn and practice critical thinking in order to meet the demands of the law, No Child Left Behind. Last, Fogarty (1997) reminded educators that brain-compatible classrooms allow time to reflect upon one's thinking. Vygotsky (1978) described reflection of thinking as the time that collective thinking becomes mental functions of the individual. He stated, "Reflection is spawned from argument" (Vygotsky, 1978, p. 47). According to Slavin (1995), students learn from one another in cooperative learning, because their discussions promote cognitive conflicts. "Inadequate reasoning will be exposed, and higher-quality understandings will emerge" (Slavin, 1995, p. 18).

Cooperative Learning

Traditional Learning versus Cooperative Learning

Traditional learning. Traditional learning involves individualistic learning. Johnson and Johnson (1999, p. 7) define individualistic learning as, "working by oneself to ensure one's own learning meets a preset criterion independently from the efforts of other students." According to Johnson and Johnson (1999), students may have their own set of materials, works at their own speed, and receives help from only the teacher. Hertz-Lazarowitz and Shachar (1990) stated teachers of traditional classrooms may not tolerate any student cooperation. The student interacts with only printed information, other visuals, and the teacher. Characteristics of traditional learning are (Johnson & Johnson, 1999, p. 72):

1. teacher lecture through possible visuals
2. individual student goals and tasks

3. competition
4. individual assessment

Advantages to traditional learning deal with the teacher (Hertz-Lazarowitz & Shachar, 1990). For example, a traditional classroom establishes the teacher as the authority figure. Students recognize the teacher as someone who has a controlling role, and the "territorial distinctions between teacher and student" is reflected (Hertz-Lazarowitz & Shachar, 1990, p. 80). In addition, traditional learning provides assessment situations similar to standardized testing (Janesick, 2001). The student alone answers a paper-pencil test to demonstrate mastery of learning.

However, Jensen (1996) believes traditional learning has some disadvantages. He states that traditional learning rarely provides opportunities for brain based environments. The learner in a traditional classroom is usually bored, because the instructor is usually tapping only a few parts of the brain. In addition, Johnson and Johnson (1999) claim traditional learning influences students to become exhausted, frustrated, and unmotivated. The students' achievements are individually recognized, awarded, or punished. Therefore, the learning environment leans toward the individualistic and competitive types of learning (Johnson and Johnson, 1999). In the area of mathematics, the Education Alliance (2006) stated recent mathematics test results demonstrate the need for instructional change in traditional learning classrooms. "The focus is on specific problems and not building the foundations for understanding higher level math," stated the Educational Alliance (2006, p. 2).

Cooperative learning. Instead, Johnson and Johnson (1999) adhere to a teaching method that implements cooperative learning. They believe:

> In the process of working together to achieve shared goals students come to care about one another on more than just a professional level. Extraordinary accomplishments result from personal involvement with the task and each other.
> (Johnson & Johnson, 1999, p. 67)

Johnson and Johnson (1999, p. 5) defined cooperative learning as "the instructional use of small groups so that students work together to maximize their own and each other's learning." Cooperative learning consists of the teacher as the facilitator of learning. The teacher may provide new information through various tools; however, the students work together to complete assignments. The assignments may include worksheets, games, assessments, or other projects. Cooperative groups have a specific goal to accomplish, and each team member of the cooperative group has an objective to accomplish in order to meet the goal. Therefore, the learning environment leans toward individualistic and cooperative types of learning (Johnson and Johnson, 1999). According to Johnson and Johnson (1999, p. 72) a high performance learning group "meets all the criteria for being a cooperative learning group and outperforms all reasonable expectations, given its membership."

Types of Cooperative Learning Methods

Over the years, researchers have developed various types (see Appendix B) of cooperative learning methods (Slavin, 1995): Student Teams-Achievement Divisions (STAD), Teams-Games-Tournaments (TGT), Team Accelerated Instruction (TAI), Cooperative Integrated Reading and Composition (CIRC), Group Investigation, Jigsaw II, Learning Together, Complex Instruction, and Structured Dyadic Methods.

Student Teams-Achievement Divisions (STAD) consists of five major components such as class presentations, teams, quizzes, individual improvement scores, and team recognition. Educators must utilize curriculum materials specifically designed for this cooperative learning method that involve teaching, team study time, an individual assessment, and team recognition.

Teams-Games-Tournaments (TGT) is similar to STAD; however, Teams-Games-Tournaments use academic tournaments instead of individual quizzes. The tournament is at the end of a lesson or unit. This cooperative learning method can be used in combination with STAD.

Team-Assisted Individualization (TAI) requires the use of a specific set of instructional materials and implementation guide. This method involves assigning teams, pre-testing the groups' skills, participating in a team study based on pretests, computing a team score, and teaching again students who did not understand the concepts during team study.

Cooperative Integrated Reading and Composition (CIRC) consists of basal-related activities, direction instruction in reading comprehension, and integrated language art and writing. Students work in heterogeneous teams that involve teacher presentation, team practice, independent practice, peer assessment, additional practice, and testing.

Group Investigation is one of the most commonly used cooperative learning methods (Slavin, 1995). This method involves identifying the topic and organizing students into groups; planning the learning task; carrying out an investigation; presenting a final report; and evaluating achievement.

Jigsaw II is more appropriate in subjects such as reading, social studies, science, and any other material in narrative form. Students work in heterogeneous teams to become experts on assigned topics. The experts present their learned information to the rest of the class.

Other cooperative learning methods such as Learning Together, Complex Instruction, and Structured Dyadic Methods are similar to Group Investigation; however, they also emphasize positive interdependence and individual accountability (Slavin, 1995).

Comparison of Cooperative Learning Methods

For each of these cooperative learning methods, studies demonstrate that each of these cooperative learning methods is more beneficial than the traditional learning method (Johnson & Johnson, 1999). However, there are not many studies that compare a cooperative learning method with another cooperative learning method. Regardless of the differences of each method, one can categorize cooperative learning by six principal characteristics (Slavin, 1995, p. 12):

1. Group Goals - form group goals
2. Individual Accountability - provide individual assignments and grades
3. Equal Opportunities for Success - make every team member participate
4. Team Competition - motivates students to cooperate within teams
5. Task Specialization - provide individuals unique jobs within group
6. Adaptation to Individual Needs - group or individual paced instruction

These six principal characteristics distinguish group work from cooperative learning. Group work involves giving one assignment for a group to work on, and most of the time

one person ends up completing all the work. In contrast, cooperative learning provides a group goal that needs everyone's cooperation in order to be accomplished.

Researchers conducted a study in the late 1990s and found that most teachers self-teach themselves cooperative learning methods due to lack of funding and utilize a combination of the cooperative learning methods (Sparapani, Abel, Easton, Edwards, & Herbster, 1997). Another study found that if teachers did not adhere to the principles of cooperative learning, the method was unsuccessful (Nath & Ross, 1996). Therefore, according to Dotson (2001) many teachers have turned to a different cooperative learning method than the previous listed that has infiltrated many school districts across the nation - Kagan Cooperative Learning.

Kagan Cooperative Learning Method

In 1968, an educator and researcher, Spencer Kagan, initiated a research program on cooperative learning. During his research, Kagan (2000) realized that cooperative learning needed to engage the learner, align with the principles of brain compatible learning, attract a variety of multiple intelligences, embed the curriculum's standards, provide real-life applications, and permit distributed practice. Therefore, he created his own cooperative learning structures. Kagan defined cooperative learning structures as "content-free, repeatable sequence of steps designed to structure the interaction of students with each other and/or the curriculum in ways which align with basic principles and efficiently realize specific learning outcomes" (Kagan, 2000, p. 1). Some examples of cooperative learning structures are: Numbered Heads Together, Mix-Pair-Share, Mix-Freeze-Group, and Rally Coach. The structures involve students working in groups of two to four students.

Most importantly, Kagan's cooperative learning structures (2000, p. 1) meet the requirements of Slavin's principles of cooperative learning through Kagan's PIES principles:

1. Positive Interdependence - Students are positively interdependent when a gain for one is a gain for another.
2. Individual Accountability - Teacher assesses each student for his own work in the cooperative structured activity.
3. Equal Participation - Students each have a role and responsibility during the cooperative structured activity.
4. Simultaneous Interaction - Every student is actively engaged at all times.

For example, Kagan (2000, p. 1) explained that his cooperative learning structure, Rally Robin that involves collaborative pairs, follows the PIES principles:

1. Positive Interdependence - Each student are on the same side trying to discuss the correct answer.
2. Individual Accountability - Each student is required to respond and listen to his partner in order to provide feedback. Teacher circulates the room to assess.
3. Equal Participation - Each student takes turns talking about the question.
4. Simultaneous Interaction - Everyone is either responding or listening to a partner.

According to Kagan (2000), his cooperative learning structures have many advantages for teachers. He stated that his structures are content-free; therefore, a teacher can utilize them in any subject. Kagan (2000) emphasized that his structures are not one more new program for teachers to implement in the classroom. He (Kagan, 2000, p. 6) declared, "Kagan structures are a way of teaching that makes it easier and more efficient to deliver the ranger of programs demanded of teachers." In addition, teachers across the nation who use Kagan cooperative structures are using the same verbiage when discussing cooperative learning (Kagan, 2000).

Spencer Kagan (2001) claimed that his cooperative learning structures increase student achievement for all students, regardless of learning ability. For example, Jeanie Dotson (2001) conducted a quasi-experimental study in her classroom. The study involved her sixth-grade social studies students. The control group participated in traditional learning methods while the treatment group participated in Kagan's Cooperative Learning Structures such as: Think Pair Share, Rally Table, Numbered Heads Together, Showdown, Teammates Consult, and 4S Brainstorming. The teacher heterogeneously grouped her students in cooperative teams. At the end of a nine week period of exposure to cooperative learning, Dotson gave a Post-Test. According to the findings of the one-tailed t-test (Dotson, 2001), the results were statistically significant.

Proponents for Kagan's Cooperative Learning Method utilized other studies to demonstrate that Kagan's structures increase student achievement for every student, regardless of learning ability (Kagan, 2000). According to Johnson, Johnson, and Stanne (2000), Kagan Cooperative Structures do increase student achievement; however, these researchers meta-analysis study of various cooperative learning methods ranked Kagan

Cooperative Structures last out of 10 other methods. Johnson, Johnson, and Stanne (2000, p. 11) evaluated the methods on five areas:

1. ease of learning the method
2. ease of initial use in the classroom
3. ease of long-term maintenance of use of the method
4. robustness of the method (applicability to a wide variety of subject areas and grade levels)
5. ease of method's adapting to changing conditions.

Regardless of Kagan's Cooperative Structure ranking, the researchers (2000) stated that researchers need to conduct more studies for all cooperative learning methods' effectiveness. In addition, educators need to make various considerations when exposing students to various cooperative learning methods (Johnson & Johnson, 1999).

Considerations during Cooperative Learning

Type of Learning Environment

Heterogeneous versus homogeneous environment. Most educators also define cooperative learning as “mixed-ability” groups working together (Slavin, 1981). Occasionally, homogeneous groups could participate in cooperative learning activities to meet a specific need (Kagan, 1994). However, most teachers create teams of four students that include a high, medium-high, medium-low, and low achiever (Kagan, 2001). The purpose of heterogeneous grouping is to create a diverse background of ability, background, and ideas; therefore, the students learn from one another (Slavin, 1995). According to Johnson and Johnson (1988), heterogeneous groups require a need for discussion, explanation, justification, and consensus on various concepts. The

researchers (1988, p. 34) stated, “Quick consensus without discussion does not enhance learning as effectively as having different perspectives discussed, arguing different alternatives, explaining to members who need help and thoroughly delving into the material.” However, the question is whether or not gifted students are able to participate in meaningful conversations with lower achieving students. The National Association for Gifted Children (2005) believes that gifted students would benefit at times from working with homogeneous groups. Matthews and Tassel-Baska (1992) claim that higher level discussions only occur among gifted children when they challenge each other to think critically. Matthews and Tassel-Baska (1992) question whether or not low achieving students can challenge gifted students in conversations.

Many teachers implement cooperative learning within the classroom a variety of different ways, and some proponents of cooperative learning believe that there are some considerations to be made during implementation in order for cooperative learning to be successful. Johnson and Johnson (1999) defined cooperative learning as “the instructional use of small groups so that student’s work together to maximize their own and each other’s learning” (p. 5). However, grouping alone is not cooperative learning. Teachers cannot just group students and let them flounder on their own to accomplish tasks. Johnson and Johnson (1999) emphasized that the teacher must implement a number of basic elements if grouping is to be truly cooperative.

Self-contained versus inclusive settings. Public Law 94-142 and the Individuals with Disabilities Education Act of 1990 (IDEA) demand that students with disabilities receive learning in the least restrictive environment (Bradley, Sears, & Tessier-Switlick, 1997). Students with disabilities are placed in either a self-contained or inclusive

education setting, depending on their needs. A self-contained classroom is classroom where everyone is homogeneous. For example, a self-contained classroom is a classroom where everyone is homogeneous. An inclusive classroom is a classroom with heterogeneous students. In this example, an inclusive classroom would be a classroom of general education and special education students. The four fourth grade classrooms involved in this experiment were all inclusive settings. Students with disabilities were in all four classes.

According to Bradley, Sears, & Tessier-Switlick (1997), students with disabilities in an inclusion setting can benefit from heterogeneous cooperative learning. First, students with disabilities can learn from discussion, observation, and practice with other general education students. Students with disabilities need a noncompetitive environment where they can feel successful (Bradley, Sears, & Tessier-Switlick, 1997). Also, students with disabilities can form support structures with general education students, because proximity to other students is a "necessary ingredient to facilitate friendships and become involved in extracurricular activities" (Bradley, Sears, & Tessier-Switlick, 1997, pg. 389).

Teacher's Role in Cooperative Learning

The most important role in cooperative learning is the teacher's role. Without the teacher's guidance, there cannot be student achievement. The teacher must make some important decisions for the students to participate in any cooperative learning tasks. The teacher must make pre-instructional decisions, explain the task and cooperative structure, monitor, and intervene and evaluate the process (Johnson & Johnson, 1999). During cooperative learning, the students are actively engaged in learning, but the teacher must

facilitate and guide the learning. Otherwise, any cooperative learning method may be doomed to fail (Slavin, 1995). Slavin stated:

> If not properly constructed, cooperative learning methods can for the "free rider effect," in which some group members do all or most of the work (and learning) while others go along for the ride. The free rider effect is most likely to occur when the group has a single task, as when they are asked to hand in a single report, complete a single worksheet, or produce one project. Such assignments can also create a situation in which students who are perceived to be less skillful are ignored by other members. (Slavin, 1995, p. 19)

Therefore, teachers need to make some important considerations when implementing any type of cooperative learning method.

In the area of pre-instructional decisions, the teacher needs to formulate the objectives of the task, decide on the size and assignment of the groups, plan the task, and assign responsibilities to each member of the group. The objectives of the task need to be relevant and meaningful to the students' learning; otherwise, the students will not remember important concepts (Slavin, 2006). The assigned groups should consist of no more than four students who are heterogeneously grouped according to achievement level, and Kagan (2001) suggested grouping a high, high medium, low medium, and low student together. Students should also be regrouped from time to time (Castelli & Castelli, 2002). When planning the task, Kagan (2001) listed the requirements of a successful cooperative learning experience as having the following components: positive

interdependence, individual accountability, equal participation, and simultaneous interaction (PIES). Kagan (2001) stated that positive interdependence occurs when gains of individuals or teams are positively correlated; individual accountability happens when all students in a group are held accountable for a specific task or responsibility that contributes to the group's tasks; equal participation involves equal opportunity for each member of the group to have input; and simultaneous interaction permits a multitude of student interactions during the time period. Out of Kagan's requirements, one of the most vital components is individual accountability. A teacher does not want the high achieving student to take over the task, and the low achieving student to sit back and relax. Therefore, the teacher could assign responsibilities to each member of the team such as monitor, recorder, researcher, and supply manager (Johnson & Johnson, 1999). The teacher should also require an individual assessment at the end of the task to determine whether or not all students understood the objectives of the task.

In the area of explaining the task and cooperative structure, the teacher needs to explain the academic task and how to do it. Johnson & Johnson (1999) suggested explaining the task through visuals such as a flow chart. Also, Fogarty (1997) declared that rubrics provide clear expectations for the students. The teacher must also model appropriate behavior and cognitive skills for the cooperative learning task. The students tend to mimic teachers' patterns of thinking, reasoning, and behaving (Gillies & Boyle, 2005). In a study conducted by Gillies and Boyle (2005), the results of a study through videotape showed that the teachers' behavior, communication, and process of thinking impacted the students' interaction with each other in cooperative groups.

In the area of monitoring, intervening, and evaluating the process, the teacher should constantly monitor the groups to check for understanding and prevent misbehavior. At times, the teacher may need to intervene to clarify a concept, help solve a conflict, or readjust the task for the students. Evaluation is also essential to cooperative learning to assess students' understanding of the concepts learned. Johnson & Johnson (1999) stated that the educator should assess the quality and level of their reasoning processes and their skills and competencies for the required task. Some examples of assessments for cooperative learning include goal-setting conferences, standardized tests, teacher-made tests, written compositions, oral presentations, projects, portfolios, observations, questionnaires, interviews, learning logs and journals, and student management teams. However, educators should stay away from group grades, because they are unfair, debase report cards, undermine motivation, communicate to the students that their grades are beyond their control, violate individual accountability, and create resistance to learning cooperatively (Kagan, 2000). The benefit of cooperative learning on evaluating individual student achievement is that cooperative learning allows assessment to be integrated within the learning process; other students may need to be involved to demonstrate commitment to each other's learning; groups allow more modalities to be used in the assessment process; group assessments reduces possible bias from teacher; and students help one another analyze assessment data, interpreting results, and implementing improvement plans (Johnson & Johnson, 1999).

Without the appropriate and adequate planning and implementation of cooperative learning, educators may not see an increase in student achievement with cooperative learning strategies or structures. When studies indicate an increase in

achievement due to cooperative learning, the learning was not haphazard or planned at the last minute.

Cooperative Learning and Mathematics

The National Assessment of Educational Progress (NAEP) found there was only minimal improvement in America's high school students' mathematical performance from 1978-2004 on its Long-Term Trend (LTT) assessment (Kloosterman, 2010). The LTT consisted of various mathematical concepts such as number sense, measurement, geometry, data analysis and probability, and algebraic thinking (Education Alliance, 2006). The Education Alliance (2006) also stated a February 2006 study conducted by the U.S. Department of Education made evident the need for effective instruction in mathematics. Daro (2006) believed the lack of increase in mathematics scores is attributed to mathematics instruction at the elementary level. He (2006) claimed most elementary mathematics programs do not build the foundations necessary for higher-level thinking and problem-solving in mathematics.

Bosnick and Terrell (1999) reiterated that all children, kindergarten through 12th grade, must have opportunities to apply mathematical skills for future social and economic success. Mathematics is a universal language spoken in all cultures that may be utilized on a daily basis. Elementary students should start learning how to read, write, and discuss mathematics by participating in formal mathematical and logical arguments (Battista, 1999).

Therefore, the reform movement in mathematics has swept across the nation in all schools, including at the elementary level (Battista, 1999). The National Council of Teachers of Mathematics (NCTM) has developed a standards-based approach to

mathematics instruction in order to ensure all grade levels are participating in mathematics reform. The standards' focus is more on learning basic concepts and applying them to real-world applications (Bosnick & Terrell, 1999). These standards are separated into two standards. The content standards regulate what content to teach such as numbers and operations, algebra, geometry, measurement, and data analysis and probability. The process standards dictate how to teach the content through problem-solving, reasoning and proof, communication, connections, and representations (National Council of Teachers of Mathematics, 2000). In order for these standards to guide mathematics instruction, educators must hold on to the following assumptions about teaching and learning practices (Romberg, 2000, p. 9):

1. All students must have an opportunity to learn new mathematics.
2. All students have the capacity to learn more mathematics than we have traditionally assumed.
3. New applications and changes in technology have changed the instructional importance of some mathematics concepts.
4. Technological tools can create new instructional environments.
5. Meaningful mathematics learning requires purposeful engagement and interaction which builds upon prior knowledge and experience.

At a result of the NCTM's Mathematics Standards, the education field has researched, debated, and implemented a variety of best teaching practices in the area of mathematics. Some essential characteristics of an effective standards-based classroom in mathematics include (Teaching Today, 2005, p. 1):

1. Lessons that are designed to address specific concepts or skills

2. Inquiry and problem-solving focused lessons
3. Critical thinking and knowledge applications skills,
4. Student-centered learning activities
5. Appropriate and adequate time, space, and materials to complete mathematics tasks
6. Varied and frequent assessment.

In addition, teachers should implement the following best teaching practices (Teaching Today, 2005, p. 1):

1. Create a safe environment where students are safe and comfortable.
2. Establish clear rules, procedures, and routines.
3. Provide challenge, but also support.
4. Make frequent real-life, meaningful connections.
5. Use an integrated curriculum with manipulatives and technology.
6. Provide engaging educational experiences.
7. Allow for students to produce and share products.
8. Use assigned and well-managed cooperative groups.

The last teaching practice on the list of best teaching practices, cooperative learning, is a strategy utilized in mathematics in classrooms across the nation. Cooperative learning methods promote cognitive elaboration such as solving problems, integrating different points of view, and giving explanations and analyzing misconceptions through controversial discussions during mathematical tasks (Souvignier & Kronenberger, 2007). The theorists such as Vygotsky and Piaget explained that controversial discussions facilitate people to think, organize, evaluate, and project their

thoughts into reasonable, sound discussion (Johnson & Johnson, 1999). Mathematics is a discipline that lends itself to critical, collaborative thinking, because the subject is a universal language spoken in all cultures (Adeeb, Bosnick, & Terrell, 1999). Adeeb, Bosnick, and Terrell (1999, p. 32) stated, "It is a vehicle that promotes problem-solving, communication, logical reasoning, and relationships." Slavin, Madden, and Stevens (1989) also noted that the best possible mathematics program for the mainstreamed classroom would be a classroom that integrated cooperative learning with individualized instruction. Slavin (1988) found that cooperative learning has positive outcomes in mathematics such as a rise in students' self-esteem in mathematics, liking for mathematics, acceptance of other students and their thinking, and positive race relations.

There are several studies that demonstrate cooperative learning is beneficial in mathematics. For example, Johnson, Johnson, and Scott (1978) compared two methods of structuring learning goals – cooperatively and individualistically. These researchers used a series of attitude and performance measurements on 30 advanced fifth and sixth graders in mathematics. The results indicated cooperative learning in mathematics for one hour a day for 50 days facilitated more positive attitudes toward the teacher, peers, and conflict-resolution; better internal locus of control; and increase in student achievement. Another study conducted by Kuntz, McLaughlin, and Howard (2001) compared cooperative learning, small group individualized instruction, and traditional teaching of mathematics in a self-contained elementary classroom of students with disabilities. The findings showed participants of cooperative learning and small individualized group instruction scored higher on mathematics posttest scores. Also, another example by Adeeb, Bosnick, and Terrell (1999) indicated that cooperative

learning enhances success in mathematics and acceptance of self and peers' similarities and differences. These researchers incorporated cooperative game-formatted activities with the use of manipulatives in mathematics. The games involved real-life problems that elementary students had to solve using mathematics concepts and discussions. According to Adeeb, Bosnick, and Terrell (1999), the cooperative learning groups that participated in the games enhanced in acceptance of others' ideas, getting along, sharing ideas, and working as a team. Therefore, the result was a 100% attention and effort as individuals as evidenced by informal observations, journal writing, and verbal discussion (Adeeb, Bosnick, and Terrell, 1999).

However, Johnson (2000) stated that gifted students differ from their classmates in learning. She stated:

> Mathematically gifted students differ from the general group of students studying math in the following abilities: spontaneous formation of problems, flexibility in handling data, mental agility of fluency of ideas, data organization ability, originality of interpretation, ability to transfer ideas, and ability to generalize. (Johnson, 2000, p. 1)

Therefore, researchers and educators must examine gifted students and their learning in order to meet the gifted students' needs in all subjects, including mathematics.

Gifted Students and their Learning

According to the National Association for Gifted Children (2005), advancements in education and psychology brought empirical and scientific credibility to gifted education. A timeline of key dates in gifted and talented education shows that William

Torrey Harris, superintendent of public schools for St. Louis, recognized in 1868 that gifted students existed. In the early 1900s, Lewis Terman and Leta Hollingworth initiated the first published research studies on gifted children. However, the United States did not legislate the need for gifted education until the Soviet Union's launch of Sputnik in the 1950s. In 1971, former U.S. Commissioner of Education Sidney P. Marland, Jr., reported to Congress the first federal definition of gifted and talented children:

> Gifted and talented children are those identified by professionally qualified persons who by virtue of outstanding abilities are capable of high performance. These are children who require differentiated educational programs and/or services beyond those normally provided by the regular school program in order to realize their contribution to self and society. (Marland, 1972)

Later, the No Child Left Behind legislation created a new, achievement-based definition of giftedness, however it does not mandate that states use the definition:

The term "gifted and talented", when used with respect to students, children, or youth, means students, children, or youth who give evidence of high achievement capability in areas such as intellectual, creative, artistic, or leadership capacity, or in specific academic fields, and who need services or activities not ordinarily provided by the school in order to fully develop those capabilities. (Title IX, Part A, Section 9101(22), p. 544)

However, most states would concur that gifted students possess some general characteristics, not outstanding in all (ERIC Clearinghouse on Handicapped and Gifted Children, 1990, p. 2), such as:

1. superior reasoning and problem-solving ability,
2. persistent intellectual curiosity,
3. wide range of interests,
4. superior written and spoken vocabulary,
5. avid reader of advanced books,
6. great memory and comprehension,
7. insight into arithmetic problems that require reasoning,
8. creative ability and imaginative expression,
9. long periods of concentration and outstanding responsibility,
10. goal orientated and ability to set self-standards,
11. original and flexible,
12. keen observation and responsive to new ideas,
13. social poise and mature communication,
14. and challenge seeker.

The challenge in the regular classroom is for teachers to meet the needs of these gifted students, because they learn differently than the other students. Teachers must differentiate, or adapt instruction, to respond to the diverse needs of a gifted student. According to Tomlinson (1995), a differentiated classroom must offer a variety of learning options that attract different readiness levels, interests, and learning profiles.

When gifted students are required to do the same assignments as everyone else or expected to do extra work after completing their "regular" work, the teacher is not providing learning options for the gifted students. Unfortunately, the teacher tends to create cooperative learning tasks that are not challenging and easily bore the student (Tierney, 2004).

For example, in the area of mathematics, gifted learners differ from their classmates. Johnson (2000) stated, "Mathematically gifted students have needs that differ in nature from those of other students." She (2000) outlined that gifted students differ in three areas. First, gifted learners differ in the pace at which they learn. The sequential nature of mathematics curriculum places pacing as a priority. Also, gifted learners differ in their depth of understanding. Differentiation is important in mathematics, because deep levels of understanding and abstraction are possible for most mathematical concepts. Last, gifted learners are different in the interest that they hold dear to them. In mathematics, if the interest is ignored, then the mathematical interest is not developed. Consequently, the mathematical talent is not strengthened. According to Johnson (2000), the National Council of Teachers of Mathematics (NCTM) recognizes that students are not all the same in the area of mathematics. The council stated:

> The Standards propose that all students be guaranteed equal access to the same curricular topics; it does not suggest that all students should explore the content to the same depth or at the same level of formalism. (National Council of Teachers of Mathematics, 1989, p. 131)

Unfortunately, Johnson (2000) claimed that most regular elementary teachers make modifications in their instruction or curriculum for gifted students. Therefore, the teacher can differentiate instruction by providing pre-assessments for prior knowledge, assigning different tasks, and permitting intellectual, mathematics conversations. The question is whether or not a teacher can differentiate instruction in a cooperative group setting. Huss (2006) stated gifted students can participate in intellectual conversations and higher-order thinking tasks through homogeneous cooperative learning.

Related Research

Proponents for the implementation of cooperative learning in the classroom state that brain physiology and current studies demonstrate that cooperative learning increases student achievement. Therefore, many educators turn to cooperative learning to increase state standardized test scores (Slavin, 1995).

In an article, Kagan quoted Robert Sylwester:

> Teaching is generally a delightful experience when we focus on activities that students' brains enjoy doing and do well, such as exploring concepts, creating metaphors, estimating and predicting, cooperating on group tasks, and discussing moral or ethical issues. Conversely, teaching loses much of its luster when we force students to do things their brains don't enjoy doing and do poorly, such as reading textbooks that compress content, writing and rewriting reports, completing repetitive worksheets, and memorizing facts that they consider irrelevant. (Kagan, 2001, p. 1)

In recent years, educators have adjusted their curriculum and instruction based on brain physiology, the study of how the brain functions. According to Kagan (2001), understanding how the brain works and processes information through active brain imaging techniques permits scientists, researchers, and educators to view the brain in cognitive action. Also, Fogarty (1997) believed one must understand how the brain functions by identifying the parts of the brain cell such as the neuron, dendrite, synapse, neurotransmitter, electrical impulse, chemical signal, glial cell, myelin, and neural network (see Appendix C). Fogarty (1997) stated that most vital part of information processing occurs when the neurons receive a message from the senses, muscles, or other neurons as an electrical impulse. The electrical impulse travels from the axon, reaches the synapse, and transfers to the dendrite. Slavin (2006) stated that information is transferred first to the sensory register. The sensory register can only hold information for a couple of seconds. The information that a person chooses to pay attention to is then moved to short-term memory. According to Slavin (2006), the information will not continue to long-term memory if the information is not determined as meaningful learning, promoting dendrite growth. Fogarty (1997) and Kagan (2001) stated that learning becomes meaningful when the learning environment nourishes the brain, impacts the emotions, and promotes social behavior. Therefore, these researchers concurred that cooperative learning is a vehicle that meets the requirements of an enriched learning environment. They believed cooperative learning promotes dendrite growth based on observing the brain while children participate in cooperative learning.

Some researchers question whether or not there is adequate brain research on cooperative learning among gifted students. Matthews and Tassel-Baska (1992) stated

that brain research indicates learning takes place when the appropriate level of challenge stimulates students' abilities. The researchers claimed that many cooperative tasks are too easy and bore the gifted student. Therefore, the brain does not release enough of the chemicals needed for meaningful learning (Matthews & Van Tassel-Baska, 1992). However, Huss (2006) notes that homogeneous cooperative learning for gifted and high-achieving students can promote intellectual thinking when these students are working on a more difficult task.

Regardless of criticism, proponents of cooperative learning believe that the studies demonstrate cooperative learning enhances student achievement (Slavin, 2006). The studies also show that the effects are the same for all grade levels and subjects from basic skills to higher-order thinking skills such as problem solving (Johnson & Johnson, 1999). Some studies have even found that generally minorities and low-income students benefit from cooperative learning (Slavin, 2006). He stated there are positive effects of cooperative learning on student achievement for all students, regardless of race, ethnicity, family background, learning style, and ability.

First of all, some studies demonstrated that cooperative learning motivates students to learn. Slavin (2006) defined motivation as "an internal process that activates, guides, and maintains behavior over time" (p. 317). In plain language, Slavin (2006) believed motivation is "what gets you going, keeps you going, and determines where you're trying to go" (p. 317). Motivation engages students in learning activities, and cooperative learning can provide the motivation that stimulates the desire of students to learn. Students who are motivated are more likely to self-regulate their learning by consciously planning their learning, setting goals, and retaining information into long-

term memory (Slavin, 2006). Cooperative learning facilitates children to self-regulate their learning, because they are motivated to work in groups. For example, Ellison and Boykin (2005) conducted a study to determine the learning preferences among elementary school students. These researchers (2005) defined learning preferences as "inclinations toward the type of strategies and structures students believe would optimize their learning" (p. 699). A total of 138 fifth and sixth grade African-American and Caucasian students from the same public school participated in the study. Ninety-five percent of the students qualified for free and or reduced lunch. Ellison and Boykin administered a questionnaire called the Social Interdependence Scales to the students. The questionnaire is a tool attributed to researchers Johnson and Norem-Hebeisen. The tool consists of seven different items related to preferring and valuing cooperative learning. The 138 students had 10 minutes to complete the questionnaire. The results of (Table 1) demonstrated that the students preferred cooperative learning instead of competitive and individualistic learning (Ellison & Boykin, 2005).

Table 1

Descriptive Statistics for Three Learning Preferences Scores: Total Sample

Learning Preferences	Mean	Standard Deviation
Cooperative	5.79	1.24
Competitive	4.01	1.48
Individual	3.06	1.43

Note. Adapted from "Examining Classroom Learning Preferences Among Elementary School Students," by C. E. Ellison and A. W. Boykin, 2005, *Social Behavior and Personality: An International Journal, 33*, pg. 704.

However, a critic of the study could question the standard error of the sampling proportion. The researchers only questioned 138 students; therefore, one must question whether or not the researchers questioned a large enough sample of gifted students for representation. Also, Patrick, Bangel, Jeon, and Townsend (2007) found that many gifted students preferred to work independently, because gifted students end up tutoring other students, completing most of the work, or feel bored by working at everyone else's pace. However, the Pennsylvania Association for Gifted (2009) noted gifted students may prefer grouping by ability or homogeneous grouping during cooperative learning. Johnson and Johnson (1989) believe gifted students can be separated for fast-paced and accelerated tasks in cooperative groups, and these students rather prefer working with students of similar intellect.

Regardless, Slavin (1995) believed cooperative learning motivates all children to learn, because cooperative learning positively effects a student's self-esteem. According to Slavin (1995), all children need to feel well-liked by their peers and a sense of accomplishment. Cooperative learning addresses both of these self-esteem issues. Slavin (1995) noted that 11 out of 15 studies on self-esteem and cooperative learning demonstrated a positive effect on students' self-esteem. For example, Blaney, Stephan, Rosenfield, Aronson, and Sikes (1997) examined whether or not the Jigsaw cooperative learning approach with advanced organizers enhanced the self-esteem of third graders in the area of social studies. Five third-grade classes participated as the subjects of the study. There were four experimental classes and one control class. The three assessment instruments used were the Piers-Harris, Children's Self-Concept Scale, and the Teacher Inferred Self-Concept Scale. According to the instruments, the students in the

experimental classes demonstrated an increase in self-esteem after the implementation of the Jigsaw cooperative learning method. In another study, Mesler (1999) found that even gifted students in a heterogeneous cooperative group increased their self-esteem. Participants in this study included six fourth grade classrooms that were separated into heterogeneous and homogeneous cooperative learning classrooms. After implementing the same cooperative learning activities in the two different types of cooperative learning classrooms, Mesler (1999) found on the Coopersmith Self-Esteem Inventory that the heterogeneous group of gifted students increased 1.57 points while the homogeneous group of gifted students decreased by 2.42 points. Mesler (1999) noted that the competition in the homogeneous group may have been a factor in the decrease of self-esteem scores.

Also, proponents of cooperative learning believe studies demonstrate that exposure to cooperative learning promotes healthy interaction and social skills among students; therefore, students improve in their communication skills and academics by learning from each other. In the area of communication skills, Johnson and Johnson (1999) reiterated the importance of children learning how to communicate with one another to develop positive and meaningful relationships. The researchers (Johnson and Johnson, 1999, p. 63) stated:

> "School life can be lonely. Many students start school without a clear support group. Students can attend class without ever talking to other students. Although many students are able to develop relationships with classmates and other fellow students to provide them with support systems, other students

are unable to do so."

Johnson and Johnson (1999) demanded that schools create opportunities for students to communicate through learning communities. Learning communities such as cooperative groups are made of students who learn to care about and personally commit to each team member. Slavin (1995) stated traditional classroom environments do not provide opportunities for diverse students to talk; therefore, these diverse students are not able to relate to one another, because they are not making any connections through communication. Slavin's two studies in 1995 and 1997 on the effect of the Student Team Learning (STAD) cooperative learning method in racially diverse classrooms demonstrated an increase in cross-racial relationships (Slavin, 1995). Also, researchers, Cooper, Johnson, and Johnson, investigated the effects of the Johnson's cooperative learning methods in diverse classrooms. Cooper, Johnson, Johnson, and Wilderson (1980) found more positive relationships among racial groups in cooperative classrooms versus traditional classrooms. The teachers provided the students with opportunities to communicate and collaborate with one another. Johnson and Johnson (1999) declared that communication is vital to promote these kinds of positive relationships from diverse learning communities.

In the area of academics, the high, average, and low achievers benefit by listening and observing other students' thinking. Every student can visualize and solve a problem differently than another student. In addition to sharing thinking strategies, the students showcase and enhance their strengths. Therefore, the students again raise their self-esteem; consequently, leading to more risk-taking during the learning process (Panitz, 1999). Cooperation strengthens student satisfaction with the learning experience by

actively involving students in designing and completing class tasks (Johnson & Johnson, 1999). Panitz (1999) has found that this aspect is helpful for individuals who have a history of failure in academics. There is little time for discussion or contemplation on students' errors. Panitz (1999) stated that students spend time continually discussing, debating, and clarifying their understanding. When competition permeates the classroom instead of cooperation, students recognize their negatively linked fate (Johnson & Johnson, 1999). Someone is going to fail; therefore, why learn and take risks? In the area of personal development, students improve their communication skills. For example, a college professor, Craig Murie (2004), found that communication was vital in making his students a more active part of the learning process. Murie (2004, p. 1) already implemented effective teaching practices such as:

1. providing comfort in the classroom.
2. maintaining eye contact.
3. informing students you have their best interests in mind.
4. permitting students to ask questions.
5. keeping the process simple.
6. allowing students to explain their thinking.

However, Murie (2004) recognized that the lack of communication between student and student was a problem in his college mathematics class. So, Murie implemented a study during the fall semester in a mathematics remedial course. For his first mathematics exam, Murie utilized the traditional teaching method to teach the concepts. The traditional teaching method consisted of lecture, visual aids, and other materials and resources. For his second exam, Murie (2004) employed various

cooperative learning structures within his mathematics college classroom. In this case, communication involved students utilizing various Kagan Cooperative Structures: Inside Outside Circle, Rally Table, One Stray, Rally Robin, Rally Coach, and Show Down. The students taught each other through these structures by communicating and collaborating on various multi-step mathematical problems. The students (Murie, 2004, p. 2) utilized the teacher's "Five Step Method" in Kagan Cooperative Structures to solve the problems:

1. Familiarize yourself with the problem;
2. Translate to mathematical language;
3. Carry out some mathematical manipulation;
4. Check your possible answer in the original problem;
5. State the answer clearly in a sentence.

The comparison of the first and second exams (Table 2) demonstrated that the process of more communication through the cooperative learning structures improved students' scores on the second exam. Students who were frequently absent did not improve, because they had to make-up assignments on their own.

Therefore, Murie (2004) concluded he would continue to utilize the Kagan Cooperative Method that permitted more opportunities to communicate in his classroom due to an increase in student achievement. Murie (2004) felt that the college students learned to summarize their own learning in their own words when the students had to share what they were thinking in mathematics. The college students created a cognitive disequilibrium by not only having to solve mathematics' problems, but also they had to learn how to organize and communicate their thinking.

Table 2

Comparison of Exam Scores

Exam 1	Exam 2	Absences
91	104	0
97	101	0
84	99	0
85	83	0
75	82	0
83	85	0
71	80	0
54	73	0
34	42	0
85	86	1
83	78	1
57	80	1
86	90	1
86	75	1
93	82	1
65	74	2
50	61	3
80	90	4
96	83	5
79	70	5
82	61	6
82	59	8

Note. Adapted from "Effects of Communication on Student Learning" by C. R. Murie, 2004, *Kagan Online Magazine*, pg. 9.

However, one could question whether or not Murie's experimental group had a higher aptitude in mathematics than the aptitude of the control group. Most often critics question whether or not heterogeneous, cooperative groups promote growth in communication and social skills among all students such as gifted students, resulting in an increase student achievement. Brand, Lange, and Winebrenner (2004) stated that gifted students that are not permitted to interact with other gifted students are not able to

communicate at a higher, intellectual level. Also, the students are in danger of developing an elitist attitude towards other peers. Educators cannot assume that gifted students will communicate with lower ability students in a positive way. Also, proponents of cooperative learning for gifted students should not assume that communication with peers facilitate an increase in student achievement without considering the increase was due to chance or other extraneous variables such as aptitude (Ary, 2006).

In addition to promoting healthy interaction and social skills among students, studies may show cooperative learning benefits all types of learning styles and abilities (Kagan, 2000). One way to differentiate instruction is to heterogeneously group students in mixed-ability teams of three to four students (Hunter, 2004). Hunter (2004) believed that working with smaller, flexible groups permits the teacher to give additional help, raise and lower individual task difficulty according to members of the team, and provide more immediate feedback. Whole class instruction does not always meet everyone's needs, and teachers have a difficult time assessing all the students' understanding during whole group instruction. Also, one of the fundamental components of an inclusion classroom, a class with a wide range of learning abilities including students with special needs, is cooperative learning (Friend & Bursuck, 2006). A two-year study in a mainstreamed classroom conducted by Mainzer demonstrated that Slavin's cooperative learning structure, Cooperative Integrated Reading and Composition (CIRC), had higher achievement scores in reading vocabulary, reading comprehension, and language expression than in traditional classrooms (Fore, Riser, & Boon, 2006). Another study of Student-Teams Achievement Divisions (STAD) in inclusion classes demonstrated the

increase in academic achievement and social development of students (Slavin, 2006). Jeanie Dotson, a sixth grade social studies teacher, decided to also participate in a nine-week study with two of her inclusion classes. The cooperative grouping of students consisted of mentally impaired to gifted students. The control group learned through lecture while the experiment group utilized cooperative strategies. Dotson used assignment scores at the end of each lesson for comparison between the two groups, and the results (see Table 3) demonstrated that the experiment group's mean scores were higher than the control group's mean scores. Dotson (2001) claimed the study indicated that students with disabilities and gifted students could improve in academic achievement based on her test results, findings, and conclusions.

Table 3

Assessment Mean Scores

Assignment	Control Group	Experiment Group
1	76.80	83.65
2	78.64	88.38
3	76.88	95.15
4	84.00	88.46
5	74.00	77.81
6	80.83	82.38
7	75.00	85.73
8	69.52	82.16
9	76.80	87.40
10	76.56	83.58
Class Mean	76.92	85.47

Note. Adapted from "Cooperative Learning Structures Can Increase Student Achievement" by J. M. Dotson, 2001, *Kagan Online Magazine*, pg. 5.

However, a critic should question the validity of the assignment that assessed student achievement for the purposes of Dotson's study. The assessment piece could have contained items that the gifted student already mastered. At the elementary level, a national study found that teachers could eliminate an average of 35 to 50 percent of the regular mathematics and science curriculum (Matthews & Tassel-Baska, 1992). In addition, the study did not indicate whether or not an equal amount of gifted students were in the experimental and control groups. If a majority of the gifted students were in the experimental group, the mean could be inaccurate due to the high scores of gifted students. The study would be more beneficial if the researcher had utilized an ANCOVA, so the researcher could use the students' pre-existing knowledge as a covariate.

However, despite the critics of cooperative learning for all students, including gifted and high-achieving students, a meta-analyses of 12 studies on cooperative learning demonstrate cooperative learning may still have a beneficial impact on elementary and middle school gifted and high-achieving students (Neber, Finsterwald, & Urban, 2001). The meta-analyses involved various scholarly article database searches from 1982 to 1999. Four of the studies consisted of heterogeneous cooperative groups, and all four studies demonstrated an increase in student achievement and self-esteem (Neber, Finsterwald, & Urban, 2001). The other eight studies involved high-achieving students. The researchers (2001) found that high achievers demonstrated an increase in achievement in heterogeneous cooperative groups instead of individually. However, high achievers in homogeneous groups received more help and spent more time on task. Neber, Finsterwalk, and Urban (2001) conclude that the meta-analyses demonstrated that

cooperative learning can be beneficial for gifted and high-achieving students. Although, Neber, Finsterwalk, and Urban conceded:

> At the same time, current research is insufficient for deriving more precise and detailed recommendations for how to implement cooperative learning with high-ability learners. Too limited a number of studies is available; the investigators have focused on a narrow range of topics, neglecting important issues, and even with these limitations, inconclusive results were found. (2001, p. 210)

Summary

Research is accessible and available on cooperative learning. However, researchers continue to study the effect of cooperative learning on students' achievement such as standardized test scores. Researchers wonder whether or not the implementation of cooperative learning may work in every subject for every student. Also, educators must make decisions on what type of cooperative method to use in their classrooms. In addition, the review of literature indicates that few of the studies are methodologically sound or in abundance to demonstrate that exposure to cooperative learning benefits or influences gifted students' academic achievement.

Therefore, this study examined the relationship between traditional learning versus cooperative learning in fourth grade classrooms at an experimental school. The researcher chose to analyze whether or not the Kagan Cooperative Learning method raised student achievement scores in the area of mathematics for all students, including gifted and high-achieving students.

Chapter Three: Methodology

This purpose of the study was to evaluate the effects of cooperative learning in a fourth grade classroom on all students' Florida Comprehensive Assessment (FCAT) mach scores. This chapter describes the research design, research context, participants, instrumentation, reliability and validity, data collection and procedures, and data analysis.

Design of the Study

The methodology of the study was quasi-experimental research. According to Slavin (2006), experimental research is appropriate when the researcher desires to control and manipulate various variables in an experimental method. In this study, the researcher controlled the extraneous variable of the students' aptitude by utilizing the ANCOVA statistical measure. The statistical test used the fourth grade students' previous year's FCAT mathematics scores as a covariate to determine statistical differences from previous year's FCAT mathematics scores. This permitted the researcher to spot aptitude differences among the control and experimental groups. In this study, the researcher manipulated the independent variable of treatment. The treatment group consisted of two fourth grade classes, Class A and B, which participated in Kagan Cooperative Learning Structures. The two teachers implemented these structures in mathematics on a daily basis. The control group consisted of two fourth grade classes, Class C and D, which did not participate in Kagan Cooperative Learning Structures. The teachers of the control group implemented traditional learning versus cooperative learning on a daily basis in mathematics.

The specific design was a Nonequivalent Control-Group design. According to Slavin (2006), researchers cannot randomly assign subjects to treatment groups in educational classroom settings. Therefore, researchers chose quasi-experimental designs which differ only in randomization from other experimental research. In this study, the researcher chose the treatment and control group based on the experience and cooperative learning training of the teachers. Two teachers had certified training in the Kagan Cooperative Learning Method; therefore, those teachers' classes became the treatment group. Also, the third grade Florida Comprehensive Assessment (FCAT) Mathematics test was the pretest and the fourth grade Florida Comprehensive Assessment (FCAT) Mathematics test was the posttest in this research. The third grade mathematics scores enabled the researcher to check on the equivalence of the treatment and control groups. Slavin (2006) states the pretest eliminates an internal validity threat due to non-randomization of subjects. Non-randomization can present extraneous variables such as the differences in aptitude between the treatment and control groups. Therefore, the researcher utilized the third grade mathematics scores in an ANCOVA to statistically adjust the posttest score for the pretest differences.

Statement of Problem

The purpose of this study was to explore the relationship of cooperative learning among all fourth grade students, including the gifted and high-achieving population, on their student achievement through quasi-experimental research. The problem statements center around two research questions:

Research question one. At the experimental school, how does the implementation of cooperative learning affect the Florida Comprehensive Assessment Test (FCAT) mathematics scores among all fourth grade students?

Research question two. At the experimental school, does the implementation of cooperative learning affect the Florida Comprehensive Assessment Test (FCAT) mathematics scores among fourth grade gifted and high-achieving students versus traditional learning?

Statement of Hypothesis

The hypotheses were as follows:

H_{0a}: There will be no significant difference in Florida Comprehensive Assessment Test (FCAT) Math scores of fourth graders who participated in cooperative learning on a daily basis in mathematics as compared to Florida Comprehensive Assessment Test (FCAT) Math scores of fourth graders who participated in traditional learning on a daily basis in mathematics.

H_{0b}: There will be no significant difference in Florida Comprehensive Assessment Test (FCAT) Math scores of fourth grade gifted and high-achieving students who participated in cooperative learning on a daily basis in mathematics as compared to Florida Comprehensive Assessment Test (FCAT) Math scores of fourth grade gifted and high-achieving students who participated in traditional learning on a daily basis in mathematics.

Research Context

School demographic context. The following demographic information is found in the school's improvement plan (SIP, 2007). The experimental school is located in Florida, and the geographic location of the school is in the Northwest corner of the district in a rural area. The present building has been on site for 57 years. The student membership is 589 with a staff of 74. Approximately 71.3% percent of the students are on free or reduced lunch status; in result, the state designates the school as a Title I school that receives additional federal money. The population consists of a 16% black student population, 18% Hispanic population, and 64% white population. Most of the minority students are bused in from the inner city area. The Limited English Proficient students make up 5.3% of the school's population. The elementary school is a full inclusion school with an Exceptional Student Education (ESE) population of 12%. The stability rate is 91.9% compared with the district's 92.2%, and only 9.9% of absences were in excess of 21 days. Less than 10% of the students were retained in 2007. The school consists of kindergarten through 5th grades. The school is working diligently to bring the class size ratio of 18:1 in the primary grades (kindergarten through second grade) and 22:1 in the intermediate grades (third through fifth grades) to full application according to state guidelines, within two years. The school has demonstrated significant gains in test scores through best teaching practices, additional support, and effective, on-going professional development. This school also participates in Florida's Reading First Program. At the time of the experiment, the state provided additional funds for schools to improve reading proficiency among students, participated in reading professional development, provided additional resources and materials, and employed a Reading Coach to support the school. The Reading Coach's job responsibilities involved

mentoring new teachers; coaching experienced teachers; providing reading lesson plan ideas and activities across the content areas; monitoring reading progress of students; facilitating the reading assessments; and participating in any other areas of support for the teachers. The Reading Coach has participated in training in the Kagan Cooperative Learning Method in 2001, and she modeled how to utilize Kagan Cooperative Structures in the classroom.

Gifted program context. The gifted program at ABC school includes meeting a majority of the gifted students' needs in an inclusion classroom with the regular education teacher. The gifted teacher pulls out documented gifted students and other high achieving non-documented gifted students for enrichment only 1-2 times a week for one hour mathematics enrichment in the fourth grade. For the purposes of this experiment, the high achieving non-documented gifted students are students who scored a Level 4 or 5 on the third grade FCAT Mathematics test; however, they do not meet the gifted criteria for the Polk County School district. Therefore, these high achieving students are not required to be served by the gifted teacher. However, at the experimental school the gifted teacher volunteers her services to the high achieving students to receive additional enrichment in mathematics outside of the classroom.

Math research context. Also, according to the School's Improvement Plan (SIP, 2007), the school needed to improve their school's FCAT mathematics scores. In the state of Florida, the No Child Left Behind Act (2001) holds schools accountable for state standardized test scores in various subjects such as mathematics. Every school earns a school grade of an A through F, based on its FCAT scores.

Therefore, one of the mathematics' goals on the School Improvement Plan involved implementing the Kagan Cooperative Learning Method in the classroom. At the time of the study, the administration did not require the two control group classes to implement the Kagan Cooperative Learning Method due to the lack of training for both teachers of the control group classrooms.

Research Participants

Student participants. The accessible population included four fourth grade classes taught by four different teachers. All four fourth grade classes include a mixture of students from various races, ethnic backgrounds, economic background, learning abilities and learning styles.

Two fourth grade classes, Class A and B, were the treatment group. The other two fourth grade classes, Class C and D, were the control group. The treatment group received cooperative learning in mathematics on a daily basis, and the control group did not receive cooperative learning in mathematics on a daily basis. The teachers who exposed students to cooperative learning utilized the Kagan Cooperative Learning method.

All four fourth grade class contained students from various demographics, including gifted and high-achieving students. According to the Florida State Board of Education (2004), a child is gifted if he meets Florida Statute 6A-6.03019. The law (2002) states that gifted students are children who demonstrate a need for a special program; meet a majority of special characteristics on a checklist; and score two standard deviations above average on testing. However, students who are in an under-represented group such as limited English proficient or from a low-socio economic background may

also qualify for gifted services if they meet the school district's adopted guidelines for under-represented populations. The Polk County School District's adopted guidelines make exception to having to score two standard deviations above average on testing. In addition, Polk County permits high-achieving students who meet a majority of special gifted characteristics to attend the gifted program in a school for enrichment purposes. However, these high-achieving students are not documented as gifted students. For the purposes of utlizing an appropriate sample size for the control and treatment group, the sample includes high-achieving students that scored a Level 4 or 5 on their third grade FCAT Mathematics test.

Teacher participants. The Class A teacher taught for two years. Her degree is in Child and Adolescent Development, and her teacher certification is in Elementary Education, K-6. In addition, the teacher obtained training in Kagan Cooperative Learning in 2007. However, she did not implement any cooperative instruction until 2008-2009. Class B teacher has taught for six years. Her degree is in Elementary Education, and her teacher certification is in Elementary Education, 1-6. The teacher obtained training in Kagan Cooperative Learning in 2002. She has implemented the Kagan Cooperative Learning Method in her classroom since 2002. Class C teacher has taught for seven years. His degree is in Elementary Education and Educational Leadership. His teacher certification is in Elementary Education, 1-6. For the duration of the study, he did not implement any cooperative learning in his classroom. Class D teacher has only taught for two years. Her degree is in Elementary Education, and her teacher certification is in Elementary Education. For the duration of the study, she did

not implement any cooperative learning in her classroom. All four teachers are considered highly qualified by the Florida Department of Education.

Instrumentation, Validity, and Reliability

Instrument. The conductor of the experiment utilized the third grade Mathematics Florida Comprehensive Assessment Test (FCAT) as the pre-test and the fourth grade administered Mathematics Florida Comprehensive Assessment Test (FCAT) as the post-test. The treatment and control group completed the same third grade Mathematics FCAT test and fourth grade Mathematics FCAT test administered by classroom teachers at the command of the Florida Department of Education. The third grade Mathematics FCAT test was a pretest used to check on the equivalence of the groups due to lack of randomization of subjects. According to Ary, Jacobs, Razavieh, & Sorenson (2006), if there are no significant differences on the pretest, you can eliminate selection as a threat to internal validity. If there are some differences, then an ANCOVA will statistically adjust the posttest scores. The fourth grade Mathematics FCAT test was a posttest used to determine whether or not there was a difference in groups based on treatment.

After the School Improvement and Accountability Act of 1991, the Florida Commission on Education Reform and Accountability enforced the 10 standards on the Nation's "Blueprint 2000" (Florida Department of Education, 2005). The standards demanded that the state create a new statewide assessment system for accountability purposes; therefore, in the Florida Department of Education in 1997 created the Florida Comprehensive Assessment Test (FCAT) over various subject areas in different grade levels.

According to the Florida Department of Education (2005), the Florida Comprehensive Assessment Test (FCAT) assesses whether or not students have met the Florida Sunshine State Standards in various subjects. The Florida Sunshine State Standards are grade level specific benchmarks that students must comprehend by the end of a specific grade. In this study, the third grade Mathematics FCAT test, measured whether or not the students met the third grade Florida Sunshine State Standards in mathematics. The fourth grade Mathematics FCAT test measured whether or not the students met the fourth grade Florida Sunshine State Standards in mathematics as well. In addition, both tests cover five mathematics strands (Florida Department of Education, 2005):

1. Number Sense, Concepts, Operations – identifies operations and its effects on mathematics problems; determines estimates; knows how numbers are represented and used
2. Measurement – recognizes measurements and units of measurements; compares, contrasts, and converts measurement
3. Geometry and Spatial Sense – describes, draws, and analyzes two and three dimensional shapes; visualizes and illustrates changes in shapes; uses coordinate geometry
4. Algebraic Thinking – describes, analyzes, and generalizes patterns, relations, and functions; writes and uses expressions, equations, inequalities, graphs, and formulas
5. Data Analysis and Probability – analyzes, interprets, and organizes data; uses probability and statistics.

The strands represent different percentages on the Mathematics FCAT tests at specific grade levels; however, the Mathematics FCAT tests at third and fourth grade are very similar. Third grade content percentages on the Mathematics FCAT test consist of:

1. Number Sense, Concepts, and Operations – 30%
2. Measurement – 20%
3. Geometry and Spatial Sense – 17%
4. Algebraic Thinking – 15%
5. Data Analysis and Probability – 18%.

Fourth grade content percentages on the Mathematics FCAT test consist of:

1. Number Sense, Concepts, and Operations – 28%
2. Measurement – 20%
3. Geometry and Spatial Sense – 17%
4. Algebraic Thinking – 17%
5. Data Analysis and Probability – 18%.

Also, the third and fourth grade Mathematics FCAT tests are similar in that both consist of 45-50 questions, and most students must complete the questions in 120 minutes. Students who are in the exceptional student education (ESE) program may receive accommodations such as flexible scheduling, presentation, and time.

Instrument scoring. The Florida Department of Education (2005) provides Development Scale Scores (DSS) and Achievement Level (AL) Scores for the third and fourth grade Mathematics FCAT tests. The development scale score converted from scale scores of 0-500, or vertical scale score, ranges from 0-3000. The developmental scale score demonstrates grade-to-grade growth, because the score is based on linking

items. These linking items are items that appear identical on tests of adjacent grade levels, so the Florida Department of Education (2005) may relate the scores of those linking items from one grade level to an adjacent grade level to create a single scale. By utilizing the developmental scale score, a student's academic achievement may be tracked to recognize improvement, decline, or stagnancy from grade to grade in mathematics. The achievement level (AL) score involves locating the scale score (1-500) on a level of one through five. The achievement level score, similar to a stanine score, can provide a clearer picture in determining the learning ability of a student (Florida Department of Education, 2005).

The third grade and fourth grade FCAT tests are scored by the Florida Department of Education's testing contractor. The contractor utilizes automated processes to prevent human error in scoring (Florida Department of Education, 2006).

Instrument validity. The standardized tests assess whether or not each student mastered the grade level specific mathematics benchmarks in the five categories of mathematics, and the test utilizes problem-solving, critical-thinking skills. Therefore, the test is criterion-referenced. In this study, a criterion-referenced test is more appropriate to measure the student achievement of each fourth grade student, including gifted students. According to the Florida Department of Education (2005), the test contains test questions that are categorized as low complexity, moderate complexity, and high complexity to prevent the ceiling or floor effect. A low level of complexity requires the test taker to using a simple skill such as solving a one-step mathematics problem while a medium level of complexity requires the test taker to solve a multi-step mathematics

problem. A high level of complexity may require the student to justify the answer to a mathematics problem.

After field testing, test developers check the each question's "item difficulty" level. Item difficulty after field testing refers to the percentage of students who actually chose the correct answer (Florida Department of Education, 2005). For example, if 70% or more of test takers answer a question correctly, then test developers consider that test question as easy. If 40-69% of test takers answer a question correctly, then test developers consider the test question as average. Test developers consider test questions hard when less than 40% of test takers answer the question correctly. Test developers assign test item difficulty as a "p-value." The different complexities identify students achieving at relatively higher and lower level. A range of item difficulties permit the creation of a scale of student achievement. In this study, high complexity on the FCAT Mathematics test is important due to the aptitude and identification of gifted and high-achieving students.

Instrument reliability. All Florida Comprehensive Assessment Tests in every subject follow an intensive reliability process from test question construction to statistical analysis. The steps involve: item writing, pilot testing, committee reviews, field testing, statistical review, test construction, operational testing, and item release or use (Figure 1). The Florida Department of Education (2005) only uses field test questions that are statistically sound, and statistically sound items must meet Florida's "Quality Assurance Measure." In the process of test construction and after test administration, test developers measure overall test reliability such as the standard error of measurement (SEM), marginal reliability, and Cronbach's alpha.

Also, after field testing test items and conducting statistical analyses on the Mathematics Florida Comprehensive Assessment Test (FCAT) questions several times, the Florida Department of Education (2006) has made a statement that the FCAT tests are reliable due to a high agreement coefficient of .880 measured by Cronbach's alpha. Cronbach's alpha is a traditional measure of test reliability in which the degree of error is assumed to be the same at all levels of student achievement (Human Resources Research Organization, 2003).

Data Collection and Procedures

After obtaining permission from the school district and Liberty University's Internal Review Board (IRB), the researcher collected data utilizing the school's district's record-keeping system called the Interactive Data Evaluation and Assessment System (IDEAS). The IDEAS included every student's demographic data, lunch status, and test scores in Polk County. Every Polk County teacher has access to their own students' data; all administrators have access to their schools' data; and other district level personnel have access to all students' test scores in Polk County.

The researcher also collected information from ABC school's administrator and the teachers involved in the study. The administrator provided information about the school's school-wide instruction and cooperative structures in Mathematics. In addition, the teachers involved in the study pinpointed the gifted students and high achieving non-documented gifted students that attend mathematics enrichment with the gifted teacher. Class A and B teachers also submitted lesson plans to document the exposure to daily cooperative learning in mathematics lessons within the two fourth grade classes.

Data Analysis

Analysis instrument. After collecting and organizing data, the researcher utilized Microsoft Excel and PASW 17 Statistics (SPSS newer version) to analyze data. Both software programs permitted the researcher to examine the students' FCAT mathematics developmental scores.

First hypothesis analysis. For the first directional hypothesis of comparing all fourth grade scores, the researcher utilized an ANCOVA to check for statistical differences between the treatment and control group's fourth grade FCAT mathematics scores. The ANCOVA permitted the researcher to use the fourth graders' third grade FCAT mathematics scores as a covariate. In addition, Pallant (2007) states that ANCOVA is useful in situations when there is a small sample size and only small or medium effect sizes. The use of ANCOVA reduces the error variance and increases the chances of detecting a significant difference between the posttest scores.

Second hypothesis analysis. For the second hypothesis of comparing all fourth grade gifted and high-achieving scores, the researcher also utilized ANCOVA statistics to examine the location of the gifted and high achieving students' scores in the treatment versus the control group. Due to the small population of gifted and high achieving students at ABC School in fourth grade, an ANCOVA was necessary. According to Pallant (2007), an ANCOVA permits researchers to organize, summarize, and describe observations in a limited group. In this case, the limited group involves the gifted and high-achieving students in the treatment group and the gifted and high-achieving students in the control group. Therefore, the researcher of this experiment examined the results of an ANCOVA for the treatment and control group.

Chapter 4: Statistics and Findings

As stated in chapter one, this study examined the implementation of cooperative learning to fourth grade students, including gifted and high-achieving students, in mathematics. This chapter is organized to answer the two research questions posed by the researcher:

1. At the experimental school, how does the implementation of cooperative learning affect the Florida Comprehensive Assessment Test (FCAT) Math scores among all fourth grade students?
2. At the experimental school, does the implementation of cooperative learning affect the Florida Comprehensive Assessment Test (FCAT) Math scores among fourth grade gifted and high-achieving students as compared to traditional learning?

The researcher predicted based on literature review of cooperative learning the following hypotheses:

H_{0a}: There will be no significant difference in Florida Comprehensive Assessment Test (FCAT) Math scores of fourth graders who participated in cooperative learning on a daily basis in math as compared to Florida Comprehensive Assessment Test (FCAT) Math scores of fourth graders who participated in traditional learning on a daily basis in mathematics.

H_{0b}: There will be no significant difference in Florida Comprehensive Assessment Test (FCAT) Math scores of fourth grade gifted and high-

achieving students who participated in cooperative learning on a daily basis in mathematics as compared to Florida Comprehensive Assessment Test (FCAT) Math scores of fourth grade gifted and high-achieving students who participated in traditional learning on a daily basis in mathematics.

The following describes the descriptive statistics of the subjects and details the findings of the research results.

Descriptive Statistics

Treatment and Control Group Descriptive Statistics

Demographics of all fourth graders. The research population consisted of 70 fourth graders and four fourth grade teachers during the school year of 2008-2009. The four classes of fourth grade students that comprised the treatment and control groups represented various demographics (Table 4).

Table 4

Demographics of Subjects

	Treatment Group	Control Group
Measure	Number of Students	Number of Students
Females	16	12
Males	17	25
White	16	24
Black	8	8
Hispanic	9	5
Other	0	0
Reduced Lunch	23	20
Free Lunch	3	6

Note. Adapted from *"IDEAS"* by Polk County School Board, 2008.

The representation of various demographics assists the researcher in making generalizations about other fourth grade classes in the state of Florida (Ary, Jacobs, Razavieh, & Sorenson, 2006).

Learning ability of all fourth graders. The research sample also included students with different learning abilities. The researcher utilized the previous year's third grade Florida Comprehensive Assessment Test mathematics scores to describe and analyze the students' mathematical learning abilities (Table 5). The state of Florida considers students who score a Level 1 or Level 2 on any FCAT subject area test as below grade level; students who score a Level 3 are average and on grade level; and students who score a Level 4 or 5 are above average (Florida Department of Education, 2005).

Table 5

Learning Abilities of Subjects based on 3rd Grade FCAT Mathematics test

	Treatment Group	Control Group
Measure	Number of Students	Number of Students
Level 1	5	4
Level 2	4	10
Level 3	16	13
Level 4	6	7
Level 5	2	4

Note. Adapted from *"IDEAS"* by Polk County School Board, 2008.

High Achieving and Gifted Students Descriptive Statistics

According to the sample population's third grade Florida Comprehensive Assessment Test (FCAT) mathematics scores (Polk County School Board, 2009), there were 20 students who scored above average on the FCAT Mathematics test. The

researcher categorized these 20 students as the gifted and high-achieving students for examining the implementation of cooperative learning versus traditional learning in mathematics for descriptive statistics. Out of the 20 students, eight students experienced the implementation of cooperative learning in mathematics on a daily basis. Out of the 20 students, 12 students experienced traditional learning in mathematics on a daily basis.

Demographics of gifted and high-achieving fourth graders. The small group of gifted and high-achieving students represented various demographics (Table 6).

Table 6

Demographics of Gifted and High-Achieving Students

	Treatment Group	Control Group
Measure	Number of Students	Number of Students
Females	3	2
Males	5	10
White	7	7
Black	1	3
Hispanic	0	2
Other	0	0
Reduced Lunch	7	5
Free Lunch	1	3

Note. Adapted from *"IDEAS"* by Polk County School Board, 2008.

Learning ability of gifted and high-achieving fourth graders. All 20 students scored a Level 4 or 5, above grade level, on the third grade Florida Comprehensive Assessment Test (FCAT) Mathematics test (Table 7). For the purposes of this study, the researcher categorized these 20 students as the gifted and high-achieving students. In Chapter 3: Methodology, the researcher provides detailed reasons for including these students in the gifted and high-achieving category. Also, all 20 of these students receive

support and/or consultation from the experimental school's gifted teacher, regardless of whether or not these students are officially in the school district's gifted program.

Table 7

Learning Abilities of Subjects based on 3rd Grade FCAT Mathematics test

	Treatment Group	Control Group
Measure	Number of Students	Number of Students
Level 1	0	0
Level 2	0	0
Level 3	0	0
Level 4	6	8
Level 5	2	4

Note. Adapted from *"IDEAS"* by Polk County School Board, 2008.

Research Results

Results for All Fourth Grade Students

Type of statistics. The researcher utilized a one-way between groups analysis of covariance (ANCOVA) to compare the effectiveness of an intervention in mathematics on the fourth grade students at the experimental school. According to Ary, Jacobs, Razavieh, and Sorenson (2006), an analysis of covariance (ANCOVA) is a statistical technique used to control the effect of an extraneous variable that correlates with the dependent variable. In this case, the dependent variable is the fourth grade Florida Comprehensive Assessment mathematics scores; however, the covariates are the fourth graders' mathematical intellect and ability before the experiment initiated. Therefore, the researcher utilized an ANCOVA to statistically adjust the fourth grade Florida Comprehensive Assessment Mathematics scores for any initial differences between the groups by using pretest scores (Ary, Jacobs, Razavieh, & Sorenson, 2006). For the

purposes of this study, the researcher used the fourth graders' Florida Comprehensive Assessment Mathematics scores from the previous year in third grade. The conductor of the experiment chose the third grade FCAT Mathematics scores, because the third and fourth grade FCAT Mathematics tests are similar as described in Chapter 3 of this study. Using the third grade FCAT Mathematics scores as a covariate that is related to the dependent variable reduces the probability of a Type II error (Ary, Jacobs, Razavieh, & Sorenson, 2006).

Results of the ANCOVA. The researcher first checked for Levene's Test of Equality of Error Variances to determine whether or not the samples are obtained from populations of equal variance (Table 8). According to Pallant (2007), the Sig. value must be greater than .05 in order for the variances to be equal. In this case, the Sig. value is .80. Therefore, the researcher has not violated the assumption of equality of variance.

Table 8

Levene's Test of Equality of Error Variances

Variable	*F*	*df1*	*df2*	*Sig.*
4th Grade Math FCAT Scores	0.65	1	68	.800

Note. *F* = F distribution; *df* = degrees of freedom; *Sig.* = significant value. Adapted from "PASW Statistics," 2010.

After generating an ANCOVA and including the pretest scores as a covariate, the researcher found there was no significant difference between the treatment group and control group FCAT mathematics scores (Table 9). The adjusted posttest scores demonstrated there was no significant difference between the treatment and control

group's fourth grade FCAT Mathematics scores, $F = .354$, $p = .554$, *partial eta squared* = .005. There was a strong relationship between the third grade and fourth grade FCAT Mathematics scores as indicated by a partial eta squared value of .635.

Table 9

Tests of Between-Subjects Effects

Source	*Type III Sum of Squares*	*df*	*MS*	*F*	*Sig.*
Corrected Model	2220895.248[a]	2	1110447.624	58.313	.000
Intercept	1581099.864	1	1581099.864	83.028	.000
Pretest	2159415.722	1	2159415.722	113.398	.000
Group	6738.191	1	6738.191	.354	.554
Error	1275872.194	67	19042.869		
Total	1.603E8	70			
Corrected Total	3496767.443	69			

Note. [a] = R squared is .635 (Adjusted R Squared = .624). *df* = degrees of freedom; *MS* = Mean square; *F* = F distribution; *Sig*. = significant value; η^2 = eta squared. Adapted from "PASW Statistics," 2010.

Results for Gifted and High-achieving Students

Type of statistics. The researcher utilized ANCOVA statistics to examine the location of the gifted and high achieving students' scores in the treatment versus the control group. Due to the small population of gifted and high achieving students at ABC School in fourth grade, an ANCOVA is useful. According to Pallant (2007), an ANCOVA permits researchers to organize, summarize, and describe observations in a limited group. In this case, the limited group involves the gifted and high-achieving

students in the treatment group and the gifted and high-achieving students in the control group.

Results of the ANCOVA . The researcher first checked for Levene's Test of Equality of Error Variances to determine whether or not the samples are obtained from populations of equal variance (Table 10). According to Pallant (2007), the *p* value must be greater than .05 in order for the variances to be equal. In this case, the *p* value is .691. Therefore, the researcher has not violated the assumption of equality of variance.

Table 10

Levene's Test of Equality of Error Variances

Variable	*F*	*df1*	*df2*	*p*
4th Grade Math FCAT Scores	.164	1	18	.691

Note. *F* = F distribution; *df* = degrees of freedom; *p* = significant value. Adapted from "PASW Statistics," 2010.

After generating an ANCOVA (Table 11), the researcher found there was no significant difference between the treatment group (*Mean* = 1652.88, *Standard Deviation* =*.04* 16) and control group (*Mean* = 1720.50, *Standard Deviation* = 159.82). After adjusting for the pretest scores, third grade FCAT Mathematics scores, the ANCOVA demonstrates there was no significant difference between the treatment and control group's fourth grade FCAT Mathematics scores, $F = .322$, $p = .578$, *partial eta squared* = .02. There was a strong relationship between the third grade and fourth grade FCAT Mathematics scores as indicated by a partial eta squared value of .237.

Table 11

Tests of Between Subjects Effects

Source	*Type III Sum of Squares*	*df*	*MS*	*F*	*p*
Corrected Model	1331180.l265[a]	2	66590.132	3.161	.068
Intercept	501786.243	1	501786.243	23.822	.000
Pretest	111229.190	1	1111229.190	5.281	.035
Group	6791.143	1	6791.143	.322	.578
Error	358088.685	17	21064.040		
Total	57846727.000	20			
Corrected Total	491268.950				

Note. [a] = R squared is .271(Adjusted R Squared = .185). *df* = degrees of freedom; *MS* = Mean square; *F* = F distribution; *p* = significant value; η^2 = eta squared. Adapted from "PASW Statistics," 2010.

However, the researcher does note that these statistics can only be used to organize, summarize, and describe the observations at this experimental school due to the small, limited group (Ary, Jacobs, Razavieh, & Sorenson, 2006). The researcher does not infer that these statistics describe all fourth grade classrooms in America, because of the small population of 20 gifted and high-achieving students at the experimental school.

Chapter Five: Summary, Discussion, Conclusions, and Recommendations

Summary

For the benefit of the reader, this final chapter reviews the research problem and hypotheses. That review is followed by a summary of the results and a discussion of their implications.

Review of Statement of the Problem

The purpose of this study was to explore the relationship of cooperative learning among all students, including the gifted and high-achieving population, on their student achievement through quasi-experimental research. The problem statement included two research questions:

1. At the experimental school, how does the implementation of cooperative learning affect the Florida Comprehensive Assessment Test (FCAT) math scores among all fourth grade students?
2. At the experimental school, does the implementation of cooperative learning affect the Florida Comprehensive Assessment Test (FCAT) math scores among fourth grade gifted and high-achieving students as compared to traditional learning?

Review of the Hypothesis

The hypotheses were as follows:

H_{0a}: There will be no significant difference in Florida Comprehensive Assessment Test (FCAT) Math scores of fourth graders who participated in cooperative learning on a daily basis in math compared to Florida

Comprehensive Assessment Test (FCAT) Math scores of fourth graders who participated in traditional learning on a daily basis in mathematics.

H_{0b}: There will be no significant difference in Florida Comprehensive Assessment Test (FCAT) Math scores of fourth grade gifted and high-achieving students who participated in cooperative learning on a daily basis in mathematics compared to Florida Comprehensive Assessment Test (FCAT) Math scores of fourth grade gifted and high-achieving students who participated in traditional learning on a daily basis in mathematics.

Review of Methodology

The methodology of the study was experimental research, and the design was a quasi-experimental design. The specific design was a Nonequivalent Control-Group design. For the first hypothesis, randomization was not possible, because the administration at the experimental school had already assigned students to the four fourth grade classes. However, administration attempted to create classes of students from various races, socio-economic backgrounds, and learning abilities. For the second hypothesis, randomization was not possible due to the small population of gifted students. Therefore, all fourth grade gifted students and high achieving non-documented gifted students attending the gifted education enrichment program from 2008-2009 participated in the quasi-experiment. High achieving non-documented gifted students involved students who scored a Level 4 or 5 on the previous year's third grade FCAT Mathematics test. The control group, not exposed to cooperative learning, included two inclusion 2008-2009 fourth grade classes at the experimental school. The treatment group, exposed

to cooperative learning in mathematics on a daily basis, included two 2008-2009 inclusion fourth grade classes at the same experimental school. The specific cooperative learning method used was the Kagan Cooperative Learning Method. The Kagan Cooperative Learning Method consists of cooperative learning structures that are applicable in any class building, team building, or academic building lesson. The conductor of the experiment utilized fourth grade teachers and classrooms at the same school, because this experimental school required all fourth grade teachers to teach the same mathematics curriculum at a similar pace. In addition, the same gifted teacher collaborated with these teachers and worked with the same population of gifted and high-achieving students at the experimental school.

Summary of Results

The researcher analyzed inferential statistics to provide a summary of results for the study's hypotheses.

Hypothesis One

For null hypothesis one, the conductor of the experiment used an ANCOVA to check for statistical differences between the treatment and control group's fourth grade Florida Comprehensive Assessment Test (FCAT) Mathematics scores. The ANCOVA calculated the third grade FCAT Mathematics scores as a covariate to consider each student's preexisting mathematical intellect and ability. According to Pallant (2007), a covariate is a variable that may influence the dependent variable, the fourth grade FCAT Mathematics scores. The treatment group which participated in Kagan Cooperative Learning Methods did not exhibit higher scores than the control group who participated

in traditional learning methods. There was no significant difference (p = .55) in FCAT Mathematics scores between the two groups.

Statement of problem one. The study's statement of the problem centered around one research question for Hypothesis One. According to the ANCOVA results (Table 9), the answer to Research Question One is that the implementation of cooperative learning (Kagan Cooperative Learning Method) in mathematics on a daily basis did not increase Florida Comprehensive Assessment Test (FCAT) mathematics scores among all fourth grade students as compared to traditional learning at the experimental school.

Statement of hypothesis one. According to the ANCOVA results (Table 9), the researcher retains the null hypothesis. The null hypothesis was:

> H_{0a}: There will be no significant difference in Florida Comprehensive Assessment Test (FCAT) Math scores of fourth graders who participated in cooperative learning on a daily basis in mathematics as compared to Florida Comprehensive Assessment Test (FCAT) Math scores of fourth graders who participated in traditional learning on a daily basis in mathematics.

Due to the results of the experiment, the researcher retains the first null hypothesis.

Hypothesis Two

For hypothesis two, the conductor of the experiment used an ANCOVA to check for statistical differences between the gifted and high-achieving fourth graders' treatment group and the gifted and high-achieving fourth graders' control group's fourth grade Florida Comprehensive Assessment Test (FCAT) Math scores. The ANCOVA calculated the third grade FCAT Math scores as a covariate to consider each student's

preexisting mathematical intellect and ability. According to Pallant (2007), a covariate is a variable that may influence the dependent variable, the fourth grade FCAT Mathematics scores. The treatment group who participated in Kagan Cooperative Learning Methods did not exhibit higher scores than the control group who participated in traditional learning methods. There was no significant difference (p = .578) in FCAT Mathematics scores between the two groups.

Statement of the problem two. The study's statement of the problem centered around one research question for Hypothesis Two. According to the ANCOVA results (Table 11), the answer to Research Question Two is that at the experimental school, the implementation of cooperative learning (Kagan Cooperative Learning Method) in mathematics on a daily basis did not have a significant effect on the Florida Comprehensive Assessment Test (FCAT) mathematics scores among fourth grade gifted and high-achieving students as compared to traditional learning.

Statement of the hypothesis two. The conductor of the experiment retains the original null hypothesis for the second hypothesis:

> H_{0b}: There will be no significant difference in Florida Comprehensive Assessment Test (FCAT) Math scores of fourth grade gifted and high-achieving students who participated in cooperative learning on a daily basis in mathematics as compared to Florida Comprehensive Assessment Test (FCAT) Math scores of fourth grade gifted and high-achieving students who participated in traditional learning on a daily basis in mathematics.

Discussion

Comparison of Results to Other Studies

Cooperative learning will remain in the educational field, because studies have demonstrated some positive impact of the instructional method in various classrooms in the United States (Johnson, Johnson, & Stanne, 2000). Our nation's focus on standards-based curriculum and high-stakes testing directs our educational field's attention on implementing the best teaching practices in every classroom for every child. When research studies demonstrate that cooperative learning can increase student achievement, people are interested. "The combination of theory, research, and practice makes cooperative learning one of the most distinguished of all instructional practices," states Johnson, Johnson, and Stanne (2000, p. 12). However, the results of this study demonstrate that cooperative learning, specifically Kagan Cooperative Structures, versus traditional learning, did not increase academic achievement for all fourth grade students, including the gifted and high-achieving students, in mathematics.

According to the researcher's literature review on cooperative learning, the proponents for cooperative learning such as Slavin (1991), Johnson and Johnson (1999), and Kagan (2000) demonstrated that cooperative learning can increase student motivation, self-esteem, healthy interaction and social skills, and student achievement. Therefore, one could conclude that cooperative learning should positively affect mathematics. However, the critics of cooperative learning such as Patrick, Bangel, Jeon, and Townsend (2007), Brad, Lange, and Winebrenner (2004), and Matthews and Tassel-Baska (1992) stated that cooperative learning does not have a positive impact on all students, especially gifted and high-achieving students. In this study, the researcher

concentrated on student achievement for all students at the fourth grade level in mathematics. The statistics demonstrated there was not a difference in FCAT Mathematics scores between the fourth graders who participated in cooperative learning versus traditional learning. In addition, there was no statistical difference between the gifted and high-achieving fourth graders' FCAT Mathematics scores who participated in cooperative learning (Kagan Cooperative Method) versus traditional learning. The study's findings were different than the findings of studies that demonstrated the implementation of cooperative learning increased student achievement for all students.

For example, Johnson, Johnson, and Stanne (2000) found in their meta-analyses of cooperative learning methods that cooperative learning increased student achievement. These researchers did an extensive study on 164 cooperative learning studies on eight cooperative learning methods. All eight cooperative learning methods had a significant positive impact on student achievement, and the meta-analyses validated the effectiveness of cooperative learning (Johnson, Johnson, & Stanne, 2000). However, the researchers noted that Kagan's Cooperative Structures ranked last out of the cooperative learning methods examined. In addition, Johnson, Johnson, and Stanne (2000) recommended further studies be conducted on all the cooperative learning methods despite the amount of diversity of the research. Teachers who utilize cooperative learning in the classroom may implement a certain cooperative method a different way; consequently, there are different academic results (Slavin, 1995). The researchers stated:

> Finally, many of the studies conducted on the impact of cooperative learning methods on achievement have methodological shortcomings and, therefore, any differences

> found could be the result of methodological flaws rather than the cooperative learning method.
>
> (Johnson, Johnson, & Stanne, 2000, p. 15)

One study conducted by Dotson (2001) showed that the Kagan Cooperative Learning Method had positive results on academic achievement. Dotson (2001) demonstrated that Kagan Cooperative Structures improved student achievement in a sixth grade classroom. The classroom contained a heterogeneous group of learning abilities from students with disabilities to gifted and high-achieving students. However, Dotson (2001) noted that the teacher taught social studies curriculum, not mathematics curriculum as covered in this study. In addition, Dotson (2001) stated a limitation to the study could be the differences in students within each class period. Dotson (2001, p. 9) stated, "The group make-up could have affected the outcomes." Dotson did not utilize an ANCOVA to adjust for any previous social studies intellect among the students. Dotson (2001) predicted that future studies to concur with Dotson's experiment.

One example of a mathematical study is the study conducted by Johnson, Johnson, and Scott (1978), in which they compared two methods of structuring learning goals – cooperatively and individualistically. A series of attitude and performance measurements on 30 advanced fifth and sixth graders in mathematics were utilized. The results indicated cooperative learning in mathematics for one hour a day for 50 days facilitated more positive attitudes toward the teacher, peers, and conflict; better internal locus of control; and increase in student achievement. However, one could question whether or not the mathematical intelligence of the advance fifth and sixth graders had any influence over the mathematics scores. Although, Johnson, Johnson, and Scott's

study (1978) did demonstrate that cooperative learning had a more positive impact on mathematics scores versus traditional learning.

Another study conducted by Kuntz, McLaughlin, and Howard (2001) compared cooperative learning, small group individualized instruction, and traditional teaching of mathematics in a self-contained elementary classroom of students with disabilities. The findings showed participants of cooperative learning and small individualized group instruction scored higher on mathematics posttest scores. In this case, the researchers did not target the gifted and high-achieving student population. Instead, Kuntz, McLaughlin, and Howard concentrated on students with disabilities. However, the study did show an increase in test scores; therefore, cooperative learning in this case did have a positive impact on student achievement.

Another example of a mathematical study that differs from this study is the study conducted in a college mathematics class. Murie (2004) stated the traditional method of lecture and other materials were not as effective as Kagan's Cooperative Structures. He utilized these structures when students communicated and collaborated with one another to solve multi-step mathematical problems. After a pretest and posttest, Murie (2004) found the students who participated in cooperative learning had higher scores than the students who participated in traditional learning. However, Murie (2004) did state the college mathematics class contained a homogeneous group of remedial mathematics students. Therefore, the students did not really vary in mathematical aptitude or include gifted and high-achieving students as this study included a heterogeneous group of intellectual abilities. Dotson (2001) stated the Kagan Cooperative Structures are effective when the teacher creates teams with a high, medium-high, medium-low, and low

achiever. Matthews and Van-Tassel Baska (1992) found this type of heterogeneous grouping was not always effective for the gifted population. Gifted students could not challenge one another by participating in intellectual and stimulating conversation; therefore, these researchers (1992) declare more studies should be completed on the impact of homogeneous cooperative learning among gifted students.

According to Melser (1999) one study that compared grouping strategies for cooperative learning among gifted students found both homogeneous and heterogeneous groups improved reading achievement. The researcher compared two gifted self-contained classrooms with four mixed-ability self-contained classrooms. The researcher compared the gifted students' reading scores in both groups. The results showed an average increase of two points on the reading posttest. However, Mesler (1999) did not compare cooperative learning versus traditional learning. In addition, one could question whether or not the gifted students improved from the pretest scores due to high intelligence. Overall, the cooperative learning strategies did not have a negative effect on the gifted students' academic achievement; however, Mesler (1999) noted that self-esteem of gifted students decreased. Mesler stated:

> The use of flexible grouping, or changing groups may be an important key for using cooperative learning (among gifted students) and teachers may want to consider using both homogeneous and heterogeneous groups in their classrooms, depending on the subject or activity. (Mesler, 1999, p. 2)

Huss (2006) proclaimed that studies have shown gifted students benefit cognitively and affectively from working with other gifted students. Coleman and Gallagher (1995)

reported that gifted students are annoyed with having to work with other students, because the gifted students end up tutoring the other low-achieving students. Ross and Smyth (1995) declared that cooperative learning only works when it is intellectually demanding for everyone; therefore, homogeneous grouping of gifted students forces gifted students to participate in challenging, creative, and open-ended tasks on their level, especially in mathematics. Huss (2006, p. 23) stated, "Striking a balance, then, between heterogeneous and homogeneous grouping is a reasonable alternative." Perhaps, the next step in advancing the implementation of cooperative learning is to include homogeneous grouping of gifted students in action research across the nation.

While more studies are being planned and initiated, effective educators must make changes to their instruction through action research (Schmuck, 1997). According to Schmuck (1997), action research involves teachers conducting a literature review, implementing best teaching practices, and reflecting on whether or not those practices worked for their students. Then, researchers in the education field assist the educators by also examining various educational studies and sometimes implementing their own studies to further the education field to help those effective educators implement action research in their classrooms. Therefore, the education field – researchers, educators, and policy makers - are responsible for collaborating with one another by combining their research and studies to form meta-analyses on the most effective teaching strategies, including cooperative learning. Hopefully, future studies of cooperative learning will examine what components of all the cooperative learning methods truly work for every child, including gifted and high-achieving students. According to Neber, Finsterwald, & Urban (2001), there are few logically sound studies that examine the implementation of

cooperative learning among gifted students. Therefore, the education field would benefit from studies that examined large group of gifted students in homogeneous and heterogeneous settings. In addition, studies that demonstrate success in student achievement in mathematics for all students, including gifted and high-achieving students, should note in detail the necessary components included in the implementation of cooperative learning. Slavin (1987) stated that cooperative learning, when properly organized and motivated, facilitates students with a wide variety of needs and ability levels to take a great deal of responsibility for learning, their teammates' learning, and overall classroom management. The studies do demonstrate that cooperative learning does not have a negative effect on student achievement (Slavin, 1987); therefore, it would be beneficial to continue learning about this effective teaching practice and the most effective way to implement various cooperative learning methods in the elementary classroom, especially in the area of mathematics.

Limitations to the Study

The researcher of the study recognized several limitations to the study. The limitations involve making broad generalizations for all fourth grade classes in the United States based on the results and findings of four fourth grade classes at the experimental school. However, the purpose of the study was to study the effect of the implementation of cooperative learning versus traditional learning at the experimental school and not all schools across America.

First, there is a limitation of working with four different teachers. The researcher realized that these teachers have an impact on the fourth graders' Florida Comprehensive Assessment Test (FCAT) Mathematics scores, and all four teachers bring a different

personality, teaching experience, and instructional style to the experiment. Therefore, one could assume that the teachers influenced whether or not there was any effect of the implementation of cooperative learning on FCAT Mathematics scores versus any effect of the implementation of traditional learning on FCAT Mathematics scores based on their personalities, teaching experience, and instructional style. However, the researcher utilized these four classes at the same school for two reasons. All four fourth grade classes provided a larger population size for the experiment. According to Ary, Jacobs, Razavieh, and Sorenson (2006), a larger population of subjects permit the researcher to incorporate inferential statistics. In addition, the researcher utilized the four classes at the same school, because the administration at the experimental school dictated that every teacher at every grade level teach the state standards at a similar pace. However, one does realize that the researcher and administration could not monitor the treatment group teachers daily to ensure the teachers taught the Kagan Cooperative Method is mathematics on a daily basis as indicated in their mathematics lesson plans.

In addition, it is possible the make-up of the fourth grade classes could contribute to the students' test scores. However, the ANCOVA did check for preexisting mathematical intellect and ability between the two groups by factoring in the students' previous year's FCAT Mathematics test scores. In addition, the administration attempted to vary all the makeup of the fourth grade classes by mixing the student races, socio-economic backgrounds, and learning abilities.

The small effect size of the gifted population at the experimental school limited the ability to make broad statements about other fourth grade gifted students at other schools. Due to the small population of gifted students, the researcher had to also utilize

high-achieving students who did not officially qualify for the school district's gifted program. However, the researcher chose high-achieving students who scored a Level 4 or Level 5 on the third grade FCAT Mathematics test. These students also receive the same guidance and support from the gifted teacher.

Then, another limitation was defining cooperative learning lessons, activities, and structures. Many teachers have different definitions, methods, and strategies of implementing cooperative learning lessons, activities, and structures. Therefore, the researcher stipulated for the teacher to utilize the Kagan Cooperative Method that concentrated on: positive interdependence, individual accountability, equal participation, and simultaneous interaction (Kagan, 2000). The Kagan Cooperative Method provides step-by-step instructions on how to implement the Kagan Cooperative Structures; therefore, the two teachers who taught the treatment group could not really vary in implementation of the Kagan Cooperative Structures. However, the teachers who taught the control group did not have step-by-step instructions on how to implement traditional learning methods. These teachers used lecture, visual aids, and graphic organizers.

In any study, limitations prohibit researchers from making broad, generalized statements for everything and everyone. However, this study demonstrated that at the experimental school in Florida, the implementation of cooperative learning did not have an effect on all the fourth graders', including gifted and high achieving students, Florida Comprehensive Assessment Test (FCAT) Mathematics scores.

Conclusions

Proponents for cooperative learning continue to make claims that the implementation of cooperative learning increases academic achievement for every

student. Johnson, Johnson, and Smith (1991) synthesized over 300 studies on student achievement and concluded that exposure to cooperative learning resulted in higher critical thinking and social skills. In addition, Dotson (2001) stated that cooperative learning has been found to be a successful strategy at all grade levels. Spencer Kagan (2004) goes far as to declare that cooperative learning benefits all students regardless of learning style or ability. He stated, "Kagan structures engage a variety of learning styles and intelligences so each learning has opportunities to learn in his/her preferred style" (2000, p. 1). Kagan (2004) specifically endorses his Kagan Cooperative Learning Method that consists of various cooperative learning structures. However, some researchers disagree to whether or not cooperative learning works for everyone. Not everyone believes there are enough research studies to document whether or not cooperative learning works for everyone. For example, Fiedler-Brand, Lange, and Winebrenner (2009) question whether or not cooperative learning studies have demonstrated that cooperative learning enhances student achievement for gifted students. These researchers (2009) declared that cooperative learning experiences for gifted students is not the most effective, and Fiedler-Brand, Lange, & Winebrenner noted that Johnson & Johnson (1989) even stated there are times when gifted students should be segregated for accelerated assignments. The National Association for Gifted Children (2006) demands that researchers and educators conduct more studies on the implementation and effects of cooperative learning for gifted students.

The education field cannot ignore the needs of the gifted and high-achieving students, because every child should be able to "shine" in the classroom. Tierney (2004) parallelled the struggles of gifted boys with the character, Dash, in the movie, The

Incredibles. Dash, a fourth grader with special powers, struggled to keep his incredible intelligence and powers a secret from the rest of the comic world. Dash was supposed to be like every other boy, and he is not permitted to really soar. In the real world, Tierney (2004) believed cooperative learning can stifle the intelligence and creativity of gifted boys. Most teachers do not have the training to create cooperative learning tasks that are challenging; therefore, the gifted student is bored (Tierney, 2004). Differentiated instruction is a key component to a gifted child's learning.

Regardless of the questions, concerns, or controversy about the benefits of cooperative learning, educators should examine whether or not cooperative learning works in their own classrooms based on the research. Teachers need to reflect on whether or not they are implementing effective, researched classroom practices. The research should involve a series of interconnected ideas which take account of underlying beliefs and knowledge known as theories. Reflective thinking should allow for doubt and perplexity before possible solutions are reached (Hatton & Smith, 2006). In result, the questions, concerns, and controversy over the theories, implementation, and effects of cooperative learning motivate thinkers such as educators to research and experiment.

This quasi-experimental research was a study that examined whether or not the implementation of cooperative learning – specifically the Kagan Cooperative Method - affected all students, including gifted and high-achieving students, in the area of mathematics. After collecting, generating, and analyzing the fourth grade students' Florida Comprehensive Assessment Test Mathematics scores, the researcher came to several conclusions about the study. First, the researcher concluded that fourth graders who participated in the Kagan Cooperative Learning Method did not have higher FCAT

Mathematics test scores than fourth graders who participated in traditional learning. Therefore, the Kagan Cooperative Learning Method did not increase student achievement in the area of mathematics. Also, the researcher concluded that the gifted and high-achieving students who participated in the cooperative learning classrooms did not score significantly different on the FCAT Mathematics test than gifted and high-achieving students who participated in the traditional learning classrooms.

Therefore, the researcher believes that Kagan Cooperative Learning is not harmful to utilize on a daily basis in mathematics; however, traditional learning did not decrease FCAT Mathematics scores either. Perhaps, traditional learning combined with other best teaching practices such as graphic organizers, thinking maps, summarization, journal writing, and other effective instructional strategies can produce the same results as cooperative learning. Also, some studies have demonstrated cooperative learning is beneficial; therefore, educators should examine whether or not homogeneous grouping may benefit gifted students' learning.

The No Child Left Behind Act (2001) may have facilitated the educational realm to scramble for answers to raising student achievement on state standardized test scores, but the legislation also dictates that teachers are to meet all the needs of all students, including our society's gifted and high-achieving children. Therefore, policy makers, educators, and parents should focus on raising students who are well-rounded. Let us examine whether or not the implementation of cooperative learning affects not only student achievement, but also other areas of student learning. What effects does the implementation of cooperative learning – such as the Kagan Cooperative Structures – have on self-esteem, social skills, conflict-resolution techniques, motivation, or behavior?

Kuntz, McLaughlin, and Howard (2001) reminds that cooperative learning experiences in mathematics have demonstrated improved attitudes toward the subject and increases students' confidence in their own mathematical abilities; therefore, one can assume that improved self-esteem, motivation, and behavior will have a positive impact on student achievement.

Implications

While the study at hand may be too small to make any broad generalizations, the study implies that the implementation of cooperative learning does not affect the student achievement of all fourth graders, including gifted and high-achieving students, in mathematics at the experimental school. Therefore, proponents for cooperative learning such as Kagan (2004) cannot claim that the implementation of cooperative learning, such as the Kagan Cooperative Method, raises student achievement for all students in every school environment. Every classroom is unique with a make-up of students from various races, socio-economic backgrounds, and learning abilities and styles. Howard Gardner stated:

> Nowadays an increasing number of researchers believe precisely the opposite; that there exists a multitude of intelligences, quite independent of each other; that each intelligence has its own strengths and constraints; that the mind is far from unencumbered at birth; and that it is unexpectedly difficult to teach things that go against early 'naive' theories of that challenge the natural lines of force within an intelligence and its matching domains (1993, p. 23).

Unfortunately, all children do not learn the same way (Gardner, 1993). Due to high-stakes testing, school districts across the United States are searching to find the miracle solution to raising student achievement due to the pressures of high-stakes testing (Glass, 2002). However, many educators may be unfortunately turning to cooperative learning as the single easy answer. According to Thompson (2008), there is not one teaching practice that will raise student test scores. Instead, teachers should implement a variety of researched, exemplary teaching practices that work for their own school environments. According to Johnson, Johnson, and Stanne (2000), the meta-analysis of research demonstrated that cooperative learning is effective. However, Johnson, Johnson, and Stanne did not only examine student achievement, but also the researchers studied the effect of cooperative learning on interpersonal attraction, social support, and self-esteem. Perhaps, cooperative learning has a positive effect on the other parts of learning which indirectly affects student achievement. Also, concerning gifted and high-achieving students, researchers continue to claim that the implementation of cooperative learning increases student achievement for every student, regardless of ability (Kagan, 2004). However, studies have yet to prove beyond a shadow of doubt that cooperative learning increases all gifted and high-achieving students' achievement through test scores (National Association for Gifted Students, 1996). In this study, the statistics demonstrated that the implementation of cooperative learning did not affect the Florida Comprehensive Assessment Test (FCAT) Mathematics scores of the gifted and high-achieving students in comparison to the implementation of traditional learning among the gifted and high-achieving students. One can infer that gifted and high-achieving students will earn high state standardized test scores regardless of teaching or learning method.

However, grouping gifted and high-achieving students with low or average ability students will impede their advanced progress in learning (VanTassel-Baska, Landrum, & Peterson, 1992).

The researcher did note that the fourth graders, including gifted and high-achieving students, who participated in the Kagan Cooperative Learning Method, did not receive higher or lower FCAT Mathematics scores compared to the fourth grade students who participated in traditional learning. Therefore, the results of this study indicate that the implementation of cooperative learning may not raise test scores, but the Kagan Cooperative Method also doesn't decrease test scores either. Therefore, the researcher believes cooperative learning should not be discredited for making any positive impacts in the education field in other ways other than raising state standardized test scores. For example, Johnson and Johnson (2009) find that cooperative learning structures opportunities for students to experience intellectual conflicts. Intellectual conflicts facilitate students to use critical thinking skills, conflict-resolution techniques, and social skills. Other cooperative learning studies have also demonstrated that researchers make certain considerations after this study at the experimental school with fourth graders in mathematics.

There should be continued research and studies on the effects of various cooperative learning methods such as the Kagan Cooperative Method for students in student achievement. However, researchers may want to utilize a dependent variable other than state standardized test scores. Perhaps, the researcher should use assessments that occur more than once a year. Most state standardized achievement tests occur for one day, and other factors could influence the one day of testing such as test anxiety. In

addition, researchers need to continue research on the effects of various cooperative learning methods in other areas than student achievement. A well-rounded student should excel in academics and personal development. Therefore, educators should address social skills and conflict-resolution techniques. Next, researchers and educators need to conduct more studies on the effects of cooperative learning on gifted and high-achieving students. Many studies have demonstrated that the exposure of cooperative learning increases student achievement for low-achieving students; however, there lacks research and studies for gifted children. Perhaps, cooperative learning could work if educators considered what cooperative learning components are necessary to increase student achievement for the gifted and high achieving students. Perhaps, homogeneous grouping is more beneficial than heterogeneous grouping for gifted students. Huss (2006) believed cooperative learning can be successful for gifted students if teachers utilize homogeneous grouping. The National Association for Gifted Children (2006) stated that heterogeneous grouping may not meet the needs of gifted students. Fiedler-Brand, Lange, and Winebrenner (2009) believed most teachers use gifted and high-achieving students as tutors to help needy students learn. Slavin (1991) stated the use of cooperative learning does not require dismantling ability group programs. Last, researchers should consider whether or not the goal of cooperative learning for gifted students in a heterogeneous, inclusion classroom should be an increase in test scores. Perhaps, the exposure of cooperative learning may still benefit gifted students' social skills or motivation to learn. Dotson (2001) stated cooperative teams expose students to various learning styles and abilities, cultures, and economic backgrounds. Dotson (2001) recommended forming special interest groups for various projects. Researchers need to

explore different effects of cooperative learning other than just exploring student test scores for all students, including gifted and high-achieving students. Future research is recommended.

Recommendations for Future Research

Future research on the implementation of cooperative learning on all students, including gifted and high-achieving students, is essential. Johnson and Johnson (1999) reiterated how important it is for children to learn how to work together to accomplish tasks such as the tribes of people in the remote past.

The researcher believes the following problem statements should facilitate future research based on this study:

1. How does the implementation of various cooperative learning methods affect student achievement in other subjects?
2. Do heterogeneous or homogeneous grouping in cooperative groups affect student achievement of gifted and high-achieving students?
3. How does the implementation of various cooperative learning methods affect a student's motivation to learn?
4. How does the implementation of various cooperative learning methods affect a student's social skills?
5. How does the implementation of various cooperative learning methods affect a student's conflict-resolution skills?
6. What cooperative learning method has the most positive effect on a student's learning?
7. Does cooperative learning affect adult learning?

Perhaps, society does require that humans interact, collaborate, and solve problems together. According to Johnson and Johnson (1999) the necessity for the education field to prepare students for a cooperative, collaborative, and competitive society is strong; however, researchers and educators must learn a lot more about the methods, strategies, and components of cooperative learning in order for cooperative learning to work for everyone. Teachers need to concentrate on all students and making sure any student, including our gifted population, really doesn't get left behind. Huss (2006) believed that gifted students can benefit from cooperative learning in other ways than just increasing test scores. He stated in his article, *Gifted Education and Cooperative Learning: A Miss or Match*:

> Hopefully, this revisiting of cooperative learning will provide much needed validation to those teachers who currently believe wholeheartedly in the practice and recognize the increased cognitive, affective, and interpersonal benefits to their students (2006, p. 23).

People will continue to work together for various reasons in the work field. Therefore, our nation's children must have opportunities to enhance skills necessary for cooperation and collaboration. If the proper implementation of cooperative learning also has a positive effect on other areas such as academic achievement, then educators around the nation can continue to utilize this instructional practice with a combination of other best teaching practices in their classrooms based on the needs of all the students, including the gifted population.

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Appendix A

Time-Line: History of Cooperative Learning (Johnson & Johnson, 1999)

Date	Event
B.C.	Talmund
First century	Quintillion, Seneca *(Qui Docet Discet)*
1600s	Johann Amos
1700s	Joseph Lancaster, Andrew Bell
1806	Lancaster School Established in United States
Early 1800s	Common School Movement in United States
Late 1800s	Colonel Frances Parker
Early 1900s	John Dewey, Kurt Lewin, Jean Piaget, Lev Vygotsky
1929-1930s	Books on Cooperation and Competition by Maller, Mead, May and Dobb Liberty League and National Association of Manufacturers Promoted Competition
1940s	World War II, Office of Strategic Services, Military-Related Research
1949	Morton Deutsch, Theory and Research on Cooperation and Competition
1950s	Applied Dynamics Movement, National Training Laboratories; Deutsch Research on Trust, Individualistic Situations Naturalistic Studies
1960s	Stuart Cook Research on Cooperation; Madsen (Kagan) Research on Cooperation and Competition; Inquiry (Discovery) Learning Movement: Bruner, Suchman; Programmed Learning & Behavior Modification: B. F. Skinner
1962	Morton Deutsch Nebraska Symposium, Cooperation, Trust, and Conflict;

	Robert Blake and Jane Mouton Research on Intergroup Competition
1966	David Johnson, University of Minnesota, Began Training Teachers
1969	Roger Johnson joined David Johnson at University of Minnesota
1970	David W. Johnson, *Social Psychology of Education*
1971	Robert Hamblin: Behavioral Research on Cooperation/Competition
1973	David DeVries and Keith Edwards' Team-Games-Tournament
1974-1975	David and Roger Johnson Research Review on Cooperation/Competition; David and Roger Johnson, *Learning Together and Alone*
Mid 1970s	Annual Symposium at APA Began
1976	Shlomo and Yael Sharan's Group Investigation
1978	Elliot Aronson, *Jigsaw Classroom Journal of Research and Development in Education*
1979	First IASCE Conference in Tel Aviv, Israel
1981, 1983	David and Roger Johnson, *Meta-Analysis of Research on Cooperation*
1985	Elizabeth Cohen, *Designing Groupwork;* Spencer Kagan's Structures Approach to Cooperative Learning
1989	David and Roger Johnson, *Cooperation and Competition: Theory and Research*
Early 1990s	Cooperative Learning Gains Popularity Among Educators
1996	First Annual Cooperative Learning Leadership Conference in Minnesota

Appendix B

Typology of Major Cooperative Learning Methods (Slavin, 1995)

Method	*Group Goals*	*Individual Accountability*	*Equal Opportunities for Success*	*Team Competition*	*Task Specialization*	*Adaptation to Individuals*
Student Team Learning Methods						
Student Teams—Achievement Divisions	yes	yes	yes (improvement points)	sometimes	no	no
Teams–Games–Tournaments	yes	yes	yes (tournament system)	yes	no	no
Team–Assisted Individualization	yes	yes	yes (individualized)	no	no	yes
Cooperative Integrated Reading and Composition	yes	yes	yes (by subgroup)	no	no	yes
Learning Together	yes	sometimes	no	no	no	no
Jigsaw	no	yes (task specialization)	no	no	yes	no
Jigsaw II	yes	yes (task specialization)	yes (improvement points)	no	yes	no
Group Investigation	no	yes (task specialization)	no	no	yes	no
Complex Instruction	no	yes (task specialization)	no	no	yes	no
Structured Dyads	yes	yes	no	sometimes	no	no
Traditional Group Work	no	no	no	no	no	no

Appendix C

The Brain Cell Glossary of Terms (Fogarty, 1997)

Neuron: nerve cell that comprises gray and white matter in the brain

Axon: long fibers that send electrical impulses and release neurotransmitters

Dendrite: short branching that receives the chemical transmitter

Synapse: small gap between neurons through which neurotransmitters move

Neurotransmitter: chemical molecule that travels within and between brain cells

Electrical Impulse: the nerve messages receives and sent out by the neurons

Chemical signal: a message carried from neuron to neuron

Glial Cell: cells that split up and duplicate to act as glue to strengthen brain cells

Myelin: coating on the axon that serves as an insulator and speeds up transmission for outgoing messages

Neural Network: a set of connected neurons that form a strengthened path that cases and speeds the passage of the neuron transmitters

Appendix D

_____ *Elementary*

3515 _____
Lakeland, Florida 33810
(863) _____

OFFICE OF THE PRINCIPAL

August 4, 2008

Dear Parents,

At _____ Elementary School, the students participate in various learning strategies that benefit each child's learning ability, style, and preference. For example, cooperative learning is a researched strategy that motivates students to learn. Every child is accountable for his own work, but he also learns to collaborate with others when appropriate. Teachers at _____ Elementary have observed that cooperative learning can engage and motivate students, so the instruction is fun and enjoyable!

This year our classroom will have the benefit of working with Mrs. Hecox, a previous fourth grade teacher at _____ Elementary, in order to learn the benefits of cooperative learning in a fourth grade classroom. Mrs. Hecox will be using our classroom for her dissertation topic on cooperative learning by observing lessons and analyzing student data. Mrs. Hecox will not teach the students, but she will just observe me. In addition, all student data will remain confidential in her dissertation.

If you have any questions or concerns, please do not hesitate to contact Mrs. Hecox at (863) 944-1953 or myself at (863) 853-6030.

Sincerely,

Ms. _____

Appendix E

CHRISTINE C. HECOX

October 11, 2010

Dr. Gail McKinzie
1915 South Floral Avenue
Bartow, FL 33831

Dr. McKinzie,

I am preparing for my dissertation process by obtaining permission from necessary participants in my dissertation project. My purpose for writing you is to inform you that I will be utilizing _____ Elementary as a subject in my dissertation. Ms. _____ has granted me permission to use a fourth grade classroom at her school. In addition, the fourth grade teacher has also agreed to participate in the process. As a previous fourth grade teacher at the same school, I appreciate Ms. _____ and the school's willingness to help.

My dissertation involves a quasi-experimental method in order to accept or reject my null hypothesis that the exposure of cooperative learning affects gifted students on FCAT math scores. Student data will remain confidential by not using student names in the dissertation piece. In addition, the school name will be confidential as well.

Thank you for your cooperation, and please let me know if there are any permission forms I need to fill out for Polk County Schools. I have tried to contact people at the school board for information, but they have not gotten back to me. However, I understand everyone's busy schedules!

Sincerely,

Christine C. Hecox

Appendix F

ASSESSMENT, ACCOUNTABILITY AND EVALUATION
SCHOOL BOARD OF POLK COUNTY
1915 SOUTH FLORAL AVENUE
BARTOW, FLORIDA 33830
PHONE (863) 534-0688
FAX (863) 534-0770

Wilma Ferrer
Senior Director
(863) 534-0691
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"The Mission of Polk County Public Schools is to ensure rigorous, relevant learning experiences for our students that result in high achievement."

9 December 2008

Christine Hecox
15 Catbird Road
Brandenburg, Kentucky 40108

Topic: Collaboration between early childhood preschool teachers and special education teachers in early childhood inclusive community-based settings

The Polk County Public Schools Research Review Board has **approved** your "Cooperative Learning and the Gifted Student in the Elementary Classroom" research proposal. Continued approval is contingent upon:

- Continued IRB approval from your university
- Any major changes to your research project must be reviewed by the Research Review Committee to ensure continued approval.

A copy of your final research report must be submitted to Norma Hayes, Director of ESE, and my office upon competition.

If you have any questions, or if I can be of any further assistance, please contact me at the phone number or email address below.

Thanks,

Theodore Dwyer,
Chair, Research Review Board
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