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The effects of cooperative learning on student achievement in algebra I

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THE EFFECTS OF COOPERATIVE LEARNING ON STUDENT ACHIEVEMENT IN ALGEBRA I

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- ❖ Facilitate the development of and build capacity for the new innovative projects within the OT/PT/AT Programs.
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- ❖ Facilitate appropriate placement of students in elementary and secondary special education programs.
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- ❖ Provide both formal and informal assessment to determine student strengths and weaknesses and develop Individualized Education Programs (IEP) based on these results.
- ❖ Planned lessons according to state frameworks and implemented instruction, which incorporated multiple learning modalities to maximize student learning.

ABSTRACT

It is a well-documented finding that high school students in schools across the nation, including California, fail to achieve at the proficient level in mathematics, based on standardized test scores. The purpose of this research study was to compare the findings of students taught using traditional instructional methodologies versus cooperative learning methodologies. The study was conducted in four ninth grade Algebra I classes on a South Los Angeles high school campus, which has 1,700 students. Of the student population, 110 students participated in the study. The researcher utilized descriptive statistical analysis as a means to review previous student standardized test scores to determine baseline performance. After the treatment, a district adopted assessment was administered and used as a post-test to gather quantitative data to compare the scores of students who were taught using cooperative learning methodologies versus those who were taught using traditional methodologies in Algebra I.

Chapter One: Introduction

Background

United States high school seniors scored at the bottom of a multi-national study of student performance in science and mathematics, according to the results of the Third International Mathematics and Science Study (TIMSS). Results from the TIMSS, said to be the most comprehensive ever, also showed that U.S. students' aptitude for mathematics and science decline as they get older (Mullis, Martin, & Foy, 2008). Conducted in 2007, the TIMSS tested students' abilities in general mathematics, general science, advanced mathematics, and physics. In general, in mathematics and general science, the Netherlands and Sweden took top honors, while the United States ranked 19th and 16th, respectively, in a field of 21 nations. Students considered to be high achieving in the United States, fared even worse, finishing 15th out of 16 countries in advanced mathematics and placing 16th in physics—dead last. France and Norway, respectively, finished first in those disciplines. Asian nations scored highest in earlier TIMSS studies conducted with fourth and eighth graders, but chose not to participate in the high school study (Mullis et al., 2008).

Large numbers of secondary mathematics students are not proficient in math, which is the problem that the researcher addressed in the study. Educators point to numerous studies in 1990's—some favorable and some not so favorable—to assess student progress. In a 20-country comparison, American 13-year-olds outperformed only students from Jordan, Portugal, Brazil, and Mozambique in mathematics, and only students from those countries and Ireland in science (Mullis et al., 2008). According to Mullis et al. (2008), American 9-year-olds were among the highest achieving in science, along with students from South Korea, Taiwan, and Canada, but among the lowest in mathematics, along with students from Slovenia, Portugal, and England. Conducted by the Educational Testing Service and funded by the U.S. Education Department and the National Science Foundation, the study did not find any correlation between student performance and national education strategies or specific education reforms (Wainer, 1994). Within the researcher's school district the results are far more dismal.

The results of the 2007 TIMSS study (Mullis et al., 2008) is consistent with the previous TIMMS study conducted in 2003. The United States has increased its average scaled score from 504 to 508; however, that is not a significant

gain (Mullis et al., 2008). As a result, the United States Department of Education (U.S. DOE) is concerned with raising student achievement in mathematics in this country. In 2009, U.S. Secretary of Education Arne Duncan stated, "Today's results are evidence that we must better equip our schools to improve the knowledge and skills of America's students in mathematics," (DOE, 2009, p.1). He further stated that, "More must be done to narrow the troubling achievement gap that has persisted in mathematics, and to ensure that America's students make greater gains toward becoming competitive with their peers in other countries," (DOE, 2009, p. 1). Meanwhile, 28% of high school mathematics teachers and 55% of physics teachers did not specialize or major in those subjects during college; in the earlier TIMSS studies, U.S. students scored above the international average among fourth graders. However, by the eighth grade these same students fell behind their international peers. Though student achievement is at the forefront of nationwide news, states are facing issues related to low student achievement.

In California, some districts, such as Promising Future Unified School District, have recently seen improvements in student achievement in math, especially in the elementary grades. Less encouraging is that math

scores, in that same district, for middle and high school are poor and lag far behind the rest of the state.

Statement of Problem

According to the California Department of Education (2009), in the 2009-2010 school year of the students enrolled in the Promising Futures School District only 9% of those in eighth grade and 7% of those in ninth grade that were tested on the Algebra I California Standards Test were proficient. Surprisingly, 19% of students tested were proficient in mathematics as measured by the tenth grade census on the California High School Exit Exam (CAHSEE). Traditional instruction has been in use in the Promising Futures Unified School District for several years and has not shown to improve student achievement significantly. With proficiency rates in Algebra I so low, the district had implemented cooperative learning methodologies in select Algebra I classes to determine if its implementation would positively impact student achievement.

Since it was not known how cooperative learning methods would impact student achievement, the researcher compared the assessment scores of classes that received instruction through the use of cooperative learning to those classes that received traditional instruction. The

intervention included teaching students' Algebra I using cooperative learning approaches and traditional teaching strategies. According to Ozkan (2010), students' achievement in mathematics increased when they were taught using cooperative learning methodologies. The rationale for this research was to compare how well students who were taught using cooperative learning performed as measured by the Periodic Assessment as compared to their peers who were not instructed via cooperative learning. Algebra I teachers with 2 to 3 years of experience were selected to participate in professional development opportunities in the fall of 2010 so that they could implement cooperative learning in their classes at the onset of the spring semester, which began in February of 2011.

Purpose of the Study

The purpose of this quantitative study using ex post facto data was to compare the performance of 113 Algebra I students in a comprehensive high school in Promising Futures Unified School District to discern whether or not a difference existed between the performance of those students who received cooperative learning instruction in Algebra I and those who did not. The focus of this study was on 9th grade students who were enrolled in Algebra I, as the mathematics standards that are tested on the CAHSEE

should be taught by the end of the ninth grade year and passing the test is essential for students to receive a diploma. Through this study, the researcher compared two groups of students who were taught the same material in different ways and be able to examine which group of students scored higher on standardized assessments.

Research Question

The research question answered was the following: How would 56 students in two ninth grade Algebra I classes taught using cooperative learning method on a comprehensive high school campus in South Los Angeles score on the Periodic Assessment as compared to 57 of their peers in two separate Algebra I classes at the same school that were not taught using cooperative learning methodologies?

Importance of Study

This study was designed to inform teachers as to whether it is a benefit to their students to implement cooperative learning in their classrooms. There are 7.2 million teachers around the country who have taken the charge of teaching our youth, who could benefit from implementing new teaching strategies (United States Census Bureau, 2011).

Presently, the delivery of K-12 education in the United States is heavily influenced by the *No Child Left*

Behind Act (NCLB) and high stakes testing. Both teachers and administrators are searching for approaches to boost test scores and have tangible evidence that learning is taking place in all schools, especially in schools that are already in Program Improvement (PI).

In California, Program Improvement is the formal designation for Title I-funded schools and Local Education Areas (LEA) that fail to make Adequate Yearly Progress (AYP) for two consecutive years (DOE, 2009). Educational programs should be implemented to assist students in reaching their full potential and having achievement equal to that of their peers at non-Program Improvement schools. By researching instructional methodologies such as the use of cooperative learning, it can be determined if they are successful in assisting the academic development of students who are enrolled in Algebra I at a Program Improvement school.

If nothing is done to assist teachers with ways to improve student achievement on standardized tests, students will continue to perform poorly and not reach the national standard put in place by NCLB (DOE, 2009). States can intervene by taking control of a school with low test scores and reconstitute it. This means that the state will hire their own administrators and teachers, thereby

displacing those who were already working at the school site (California Department of Education, 2009). There will also be consequences for those students who are performing poorly on the standardized tests; specifically, they would not graduate with a high school diploma. Students are required to pass the California High School Exit Exam to receive a diploma (California Department of Education, 2009). If it is determined that cooperative learning improves student achievement, this method can be adopted and implemented in Algebra I courses.

Based on the literature review, there is empirical research that suggests the use of cooperative learning instruction may improve student achievement. There is a great deal of literature available discussing the positive effects of cooperative learning instruction in mathematics and how that type of instruction correlates with student learning. However, this research measured student achievement as indicated by criterion referenced assessments. Based on these assessments numeric scores were converted to attributes as a way to measure students' levels of proficiency as defined by NCLB.

All people learn through the information relayed to their brains by their senses. This information is primarily relayed through sight (visual), hearing (auditory), or

muscle movement (kinesthetic). Learning is processing information for understanding, recall, and using it in new situations (Alexander, Schallert, & Reynolds, 2009). In this context, learning styles differ from person to person. This difference is more than merely a matter of preference; learning styles are part of the complex ways in which the human brain works. Cooperative learning instruction can be carefully designed to reach the auditory, visual, and kinesthetic pathways simultaneously. Cooperative learning instruction allows students to learn new skills and concepts through their most reliable learning modality, whatever that may be (Multisensory Learning Academy, 2005).

This study will potentially benefit both teachers and students. Teachers will benefit by having a researched based instructional strategy in their repertoire to teach student. If the use of cooperative learning does contribute to an increase in student performance, this method could be adopted district-wide in all mathematics classes. Increased student achievement in Algebra I will have a positive impact on Academic Performance Index (API) score, which could assist schools in exiting Program Improvement (PI) status. Additionally, if students are proficient in Algebra I, this will be reflected in their scores on the CAHSEE,

which will allow a greater number of students to receive their high school diploma.

The research of Sharan (2010) indicated that cooperative learning may have the ability to improve student's social skills. Social interaction among students is an essential ingredient in school life, and as such it is important for teachers and administrators to monitor and analyze student relationships. According to the National Education Association (2010), 79% of bulling takes place on campus during the school day. The effective implementation of cooperative learning fosters a feeling of commonalities among students that allows for bonding, which may result in a decrease in bullying behavior.

Yet in this study, the focus will be on the effectiveness of cooperative learning in the academic arena. Research conducted by Ifamuya and Akinsola (2008) provided evidence that the use of cooperative learning is an effective method of teaching mathematics, which resulted in active participation by the students and increased intellectual involvement. This led to increased scores on standardized assessments. Of the many studies conducted related to cooperative learning, none of them took place in the inner-city. Therefore, the researcher would like to add to the existing body of literature by examining the use of

cooperative learning in an inner-city school with minority students, some of whom are English Language Learners (ELL).

Limitations

There were some limitations to this study. One limitation was the small number of students who participated in the study. The study was conducted at a high school with 1,627 students and the researcher focused on ninth grade students who were enrolled in Algebra I classes; therefore, the pool of participants was not inclusive of the entire student body. However, the sample of roughly 113 students was representative of the demographics of the entire school. The researcher believed that this number of students was sufficient to answer the research question as it has been described by Oortwijn, Boekaerts, and Vedder (2008) that students acquire mathematical information better through the use of cooperative learning. This study was to build upon their research and determine if the same results would apply to proficiency rates and increase the school's Adequate Yearly Progress. The second limitation was the school in which this study was conducted is located in an urban school district and the majority of its students are ethnic minorities from low socio-economic status. This presented itself as a limitation as there are issues faced in urban

school districts, such as crime and violence, that are not present in suburban areas. Incidentally, 19% of the student population at this particular school are ELL. This could have skewed the results if students perform poorly on the assessment due to their lack of English proficiency.

Delimitations

This study was conducted in an urban school district in South Los Angeles because it would not have been feasible to study a large sample due to costs associated with travel. Additionally, this study called for teachers to be trained in a specific methodology of cooperative learning, which had been planned in Promising Futures Unified School District. At the principal's discretion, certain secondary teachers were allowed to participate in a professional development course that demonstrated how to effectively implement cooperative learning. Only two Algebra I teachers from Bright Futures High School attended the course, which is why study group was small. The teachers received the training at the end of the fall 2010 semester, so that they were able to begin implementation of cooperative learning during the spring 2011 semester in preparation for the California Standards Test. There were math teachers of other subjects, such as geometry and trigonometry, who were trained in the methodology, but

their classes were not as homogeneous as Algebra I courses, so the results of the assessments may not have been as reliable. Furthermore, ninth grade was ideal as the standards taught in Algebra I are heavily tested on the CAHSEE, so receiving Algebra I instruction via cooperative learning may help students garner higher scores on that exam.

Definition of Terms

For the purposes of this study the following words and abbreviations are defined.

Cooperative Learning (CL). Cooperative learning is a teaching methodology where students work together in small groups that usually include no more than six students each (Ozkan, 2010).

California High School Exit Exam (CAHSEE). The CAHSEE is a statewide test given to students beginning in the 10th grade; a passing score on this exam coupled with successful completion of district graduation requirements permits students to receive a high school diploma (California Department of Education, 2009).

No Child Left Behind (NCLB). The NCLB act is the bipartisan landmark education reform law designed to change the culture of America's schools by closing the achievement gap among groups of students, offering more flexibility to

states, giving parents more options and teaching students based on what works. Under the law's strong accountability provisions, states must describe how they will close the achievement gap and make sure all students, including those with disabilities, achieve academically (California Department of Education, 2009).

Individualized Education Program (IEP). An IEP is an educational program that outlines a student's disability, present levels of performance and academic, behavioral and social emotional goals to be addressed by members of the IEP team over the course of a year (California department of Education, 2009).

Limited English Proficiency (LEP). LEP students are students who are unable to communicate proficiently in English due to their minimal experience learning the language (California Department of Education, 2009).

No Child Left Behind (NCLB). The NCLB act is the bipartisan landmark education reform law designed to change the culture of America's schools by closing the achievement gap among groups of students, offering more flexibility to states, giving parents more options and teaching students based on what works. Under the law's strong accountability provisions, states must describe how they will close the achievement gap and make sure all students, including those

with disabilities, achieve academically (California Department of Education, 2009).

Program Improvement (PI). All schools and local educational agencies (LEAs) that do not make Adequate Yearly Progress (AYP) are identified for PI under the No Child Left Behind Act of 2001 (California Department of Education, 2009).

Specific Learning Disability (SLD). A SLD is a disorder in one or more of the basic processes involved in understanding or in using written or spoken language. A specific learning disability shows itself in the child's ability to listen, think, speak, read, write, or to do mathematical problems (California Department of Education, 2009).

Traditional teaching. Traditional teaching includes instruction that is based in lecture that allows for little interaction amongst the teacher and students (Schwerdt & Wupperman, 2011).

Assumptions

The researcher assumed that both teachers who were implementing cooperative learning had done so judiciously and with fidelity in order to provide their students with

instruction that they needed to perform well on the Periodic Assessment. In addition, he assumed that the Algebra I teachers who did not receive the training were not incorporating cooperative methods in their classes to assist their students in learning concepts. It was also assumed that students perform poorly on assessments because they have not learned the common core content standards of Algebra I that were presented to them on the standardized tests. This may have be a direct result of the instruction that they received in their classroom.

Chapter Two

Literature Review

Introduction

In the last decade, there have been sweeping reforms made to the United States educational system. These reforms have resulted in progressively higher demands being placed on students, teachers, and administrators; the most notable is the No Child Left Behind Act (NCLB). Gagnon and Maccini (2006) stated, "These demands are measured through mandatory district and state assessments; some of which directly affect whether or not students graduate" (p.7).

In the state of California, where this research conducted, students are required to take and pass the California High School Exit Exam (CAHSEE) to be eligible to receive a diploma. This test is composed of two sections: English Language Arts and mathematics. Students may attempt the test a total of five times beginning in March of their tenth grade year. Once a section is passed, the student is not required to test again in that area. According to the California Department of Education (CDE), only 65% of tenth graders that tested in 2008 passed the exam (California Department of Education, 2009).

The results for students with disabilities are of even graver concern as only 21% of students with learning

disabilities successfully passed the exam (California Department of Education, 2009). The mathematics section of the CAHSEE tests students on concepts such as Algebra I and functions, measurement and geometry, as well as number sense. Since most of the standards on the test should have been taught to students by the time they leave middle school, low student achievement is not just a concern in high school: It is a concern in elementary and middle schools as well (Ross, Xu, & Ford, 2008).

Secondary level teachers expect students to receive foundational knowledge in elementary school, before being promoted to middle school. However, data published by the California Department of Education (2009) stated elementary school students are not adequately prepared in mathematics. The data showed that 23% of fourth graders scored below basic, while 32% of eighth graders scored below basic in mathematics. Unfortunately, these data do not indicate which students are having difficulty with which mathematics content standards because California Standards Test (CST) scores are not broken down and analyzed by standard. As a result, it is difficult for teachers to develop targeted intervention for these students (Neild, Balfanz, & Herzog, 2007).

Then again, if students are inadequately prepared for mathematics in elementary and middle school, it is certain they are not going to be prepared for the rigors of high school mathematics (Kalder, 2007). For that reason, it is imperative to have effective teaching at the primary level of education to ensure student success. Whereas NCLB focuses on high standards and accountability for student learning (DOE, 2009), the Individuals with Disabilities Education Act (IDEA) assures that all students are "included in current educational reform via mandated access to the general education curriculum to the greatest extent possible and participate in assessments with accommodations as needed" (DOE, 2009, p. 1). As a result of the aforementioned legislations, teachers and administrators must develop innovative new ways to support student learning.

With NCLB and the reauthorization on the Individuals with Disabilities Education Improvement Act (IDEIA) of 2004, Response to Intervention (RtI) became an important student achievement support tool for school districts. NCLB indicates RtI should be used to increase accountability for student achievement, as well as a way to increase the proficiency rates of students who are English Language Learners (California Department of Education, 2009). In

addition, IDEIA suggests RtI be used as a way to identify students who may have a Specific Learning Disability (SLD).

Since the 17th century, educational theorists have researched various ways that students should be taught. Traditionally, Algebra I had been taught, like many other subjects, through the use of lecture and two dimensional (2D) objects drawn on the chalkboard (Hwang, Su, Huang, & Dong, 2009). These methods encourage reliance on the memorization of formulas without allowing students the hands on opportunities needed to construct meaning out the formulas and concepts (Hwang et al., 2009). Student acquisition of mathematical terms indicates students are able to take what they have learned, engage in higher-order thinking regarding mathematical concepts, and begin to engage in reflection (Hwang et al., 2009).

In this study, the researcher discussed the historical aspects of teaching and learning and contemporary teaching methodologies in relation to using cooperative learning as a way of providing access strategies for students to increase their achievement in Algebra I. Exploring these variations of cooperative learning provided necessary grounding for the researcher to determine whether his study is of relevance to today's educational community, and if it

would be of value to the current Algebra I instruction literature base.

The purpose of this quantitative study of ex post facto data was to compare the performance of 113 Algebra I students in a comprehensive high school in Promising Futures Unified School District to discern whether or not a difference exists between the performance of those students who received cooperative group math instruction and those who did not. This chapter will present fundamental factors associated with the use of cooperative learning strategies including: learning styles and learning styles theories, multiple intelligences, and Response to Intervention (RtI). In addition, it will explore the findings from various research studies pertaining to its implementation in various educational settings. The information offered here will define cooperative learning along with the elements of cooperative learning. The types of cooperative learning that have been implemented at school sites will also be presented, as well as, their strengths, areas of concern, and any other cooperative learning information available in relation to this study.

Learning Styles Theory

When considering cooperative learning as an instructional methodology, one must also consider student

learning styles. Price(1992) acknowledged Learning Styles Theory as an ever increasing area of study being examined as a way to increase student performance through improved instruction. When teachers are aware of students' preferred learning style, they are able to optimize instructional delivery for increased lesson retention. Learning styles include the type of environment in which a student enjoys learning, as well as instructional activities, social activities, and intrinsic motivation (Price, 1992). Teachers should consider this information key when deciding to implement an instructional methodology, so they can maximize learning for all students and increase student performance (Price, 1992).

Multiple Intelligences Theory

According to Gardner (1983/1993), all students are not capable of processing information the same way. Their processing method is dependent on their specific profile of intelligence. In typical classrooms, teachers tend to only focus on two intelligences, using linguistic and logical-mathematical symbolization as a means to teach and assess students (Gardner, 1983/1993). In response to this, Gardner (2003) developed the multiple intelligence theory. The multiple intelligences theory includes varied forms of intelligences that can be found within the context of the

classroom as well as in naturally occurring environments outside of the school site.

Gardner (1983/1993) defined intelligences as the ability to demonstrate problem solving skills, which is not limited to answering questions on a written exam or test. Originally, Gardner (1983/1993) indicated there were seven multiple intelligences: bodily-kinesthetic, verbal-linguistic, interpersonal, intrapersonal, logical-mathematical, visual-spatial, and musical. However, there has been a recent addition of an eighth intelligence: naturalist (Silver, Strong, & Perini, 2000).

Bodily-Kinesthetic. Bodily-kinesthetic intelligence indicates students have the ability to use their body and environment to solve problems. Students who prefer this mode of learning typically have the ability to coordinate physical movements mentally and retain information they gather through physical activity. These types of students would do well with any type of hands-on activity that allows for the use of manipulatives or a physical activity (Snowman & Biehler, 2003). Therefore, teachers should maximize physical activity as it relates to a lesson in order to provide bodily-kinesthetic intelligent students with a thoughtful and engaging connection to the curriculum (Silver et al., 2000).

Verbal-Linguistic. Verbal-linguistic intelligence involves students having the aptitude to use language to accomplish a task. For teachers to nurture this intelligence, students should be given multiple opportunities to read and express themselves, allowing them to further develop their expressive and receptive language skills. Prime learning activities for verbal-linguistic students should incorporate creative tasks such as poems, essays, or speeches (Snowman & Biehler, 2003).

Interpersonal. Students who have interpersonal intelligence have the ability to understand their peers, as well as their peers' intentions, motivations, and desires. As these students are intuitive and sensitive to the feelings and mood of those around them, they tend to effectively work in a group setting. As they have an increased ability to understand the perspectives of others, and can use that ability with other students to make connections, cooperative learning is ideal for the interpersonally intelligent student (Snowman & Biehler, 2003).

Intrapersonal. Conversely, intrapersonal intelligence is the ability to understand oneself (Snowman & Biehler, 2003). Students who fall into the intrapersonal category possess a high level of self-awareness and are capable of

fully understanding their own emotions, goals, and motivations Intrapersonal intelligent students often set personal goals and do their best to achieve their goals. Intrapersonal intelligent students will find success working with groups, and using a log to track their own personal learning (Snowman & Biehler, 2003).

Logical-Mathematical. Some students have the ability to analyze problems logically and deduce specific outcomes. These students would be considered as possessing logical-mathematical intelligence. In an effort to support this type of learning, teachers should incorporate lessons that include tasks such as reviewing patterns, if-then statements, and pros and cons (Snowman & Biehler, 2003).

Visual-Spatial. Students with strong visual-spatial intelligence are talented when it comes to visualizing and mentally manipulating objects. They have a good visual memory, and many are also quite artistic. Visual-spatial intelligent students will excel when given opportunities to create story boards and presentations (Snowman & Biehler, 2003).

Musical. Students who possess musical intelligence typically utilize musical abilities to solve problems, create responses, and acquire new information. In addition, musically intelligent students have an inclination towards

communicating and learning through the use of rhythm. Students who are musically intelligent may use pencils to tap out rhythms on their desks as they are working, or perhaps hum as a way of concentrating on a given task (Gardner, 1983/1993).

Naturalistic. The naturalistic intelligence involves the ability to draw on materials and features of the natural environment to solve problems. Naturalistic students typically have a keen awareness of nature in their surroundings and tend to be able to recognize patterns in the natural environment (Gardner, 1983/1993).

From the above theory of multiple intelligences, learning styles have been simplified to include three primary modes of learning. The three primary modes of learning are visual, kinesthetic, and auditory (Douglas, Burton, & Reese-Durham, 2008). According to learning style theory, those students who are visual learners need to see information in order to process and learn it. Therefore, the use of pictures and diagrams is an optimal mode of learning for visual learning students to grasp the concept being taught. A student who is considered to be an auditory learner processes information best when the stimuli is spoken, such as listening to a lecture. Then there are kinesthetic learners, who prefer to learn in an environment

where they can be physically involved in the learning process (Zapalska & Dabb, 2002).

Cooperative learning as a teaching strategy encompasses the various intelligences; therefore, cooperative learning may be an effective method that can be used in a way to increase teaching and learning for all students. With cooperative learning as a teaching methodology, the lesson can be designed so students are able to participate as active learners, decision makers, and problem solvers (Janes, Koutsopanagos, Mason, & Villaranda, 2000).

Through the use of cooperative learning and understanding of multiple intelligences, teachers can offer a paradigm shift where students take responsibility for their own learning. The curriculum taught would continue to be standards-based; however, teaching would become more student-focused. Using multiple intelligences in conjunction with cooperative learning groups allows students to make choices about their learning. In turn, rather than merely memorizing facts for a test, students are inspired to seek out knowledge for a purpose, which increases retention (Janes, Koutsopanagos, Mason, & Villaranda, 2000).

The use of cooperative learning in instructional practices lends itself well to Response to Intervention (RtI) since students are already working in small groups. In the next section RtI will be discussed in greater detail, as well as how it relates to cooperative learning.

Response to Intervention

Response to Intervention (RtI) is a system of tiered intervention that can be used for early identification and support of students with learning and behavior needs. The framework of RtI should be used for prevention of student regression and behavioral issues (Zirkel & Thomas, 2010). RtI can also serve as a vehicle for early intervention with students having learning difficulties. This process involves determining whether all students are learning and progressing adequately when provided with high quality instruction and intervention (Thomas & Dykes, 2011).

In California, RtI is a data-driven systematic approach to instruction that should benefit every student. As such, California has expanded the notion of RtI to Response to Intervention and Instruction (RtI^2) and it has been adopted in all school districts throughout the state (California Department of Education, 2009). This is intended to communicate the full spectrum of instruction from general core, supplemental, or intensive, in order to

meet the academic and behavioral needs of students. RtI^2 integrates resources from general education, categorical programs, and special education through a comprehensive system of core instruction and interventions to benefit every student (Ehren, Deshler, & Graner, 2010).

Components of Response to Intervention

RtI^2 is comprised of several components and these components are separated into three tiers of intervention (see Figure 1). Some components are weaved throughout each tier, while others are tier-specific.

The first tier, Universal Access, indicates that all students should receive certain benefits to ensure learning (Zirkel & Thomas, 2010). In tier one, all students should be receiving high-quality, research-based classroom instruction. As there is an emphasis being placed on researched-based instructional design, and cooperative learning methods are research-based, it would be suitable for teachers and administrators to consider the use of cooperative learning in tier one. In tier one, it is essential for teachers to be proactive, focusing on prevention so students do not lag behind. Students are moved between tiers based on the teacher's assessment, which is why on-going progress monitoring is an essential component in all tiers of RtI^2 (Thomas & Dykes, 2011).

When a student is screened and determined to need tier two intervention, instruction is adjusted and targeted intervention is provided based on the students' unique needs. In both tier two and tier three, the frequency, duration, and intensity of the intervention increase based on student's need (Ehren et al., 2010). In addition, as a student moves into a higher tier, the size of the group decreases. Once in tier two, a group should not contain more than three to five students. This is so instruction can be targeted and specific (Thomas & Dykes, 2011). The small group also allows for immediate feedback to students while they receive intervention. Students who require tier three intervention receive intervention on an individualized basis (Thomas & Dykes, 2011).

Tier three intervention is very intensive, and accompanying this process, the student still receives intervention within tier one and tier two as a means to increase overall learning and academic success. As such, RtI^2 is a fluid process. Students move freely between the tiers based on their level of progress; however, the main goal still remains to serve the majority of students in tier one using universal access strategies (Basham, Israel, Graden, Poth, & Winston, 2010).

According to Basham et al. (2010), universal access indicates the framework for delivering instruction is researched-based. Additionally, instruction should allow for flexibility in the way material is delivered so students can be actively engaged, with multiple ways to demonstrate mastery of a subject. Universal access lowers students' affective filters and limits barriers to instruction, while providing accommodations and supports for all students who need them, including students with disabilities and English language learners. As the purpose of universal access is to provide a method of removing barriers to student achievement, it is therefore a crucial component of RtI^2 (Basham et al., 2010).

Cooperative Learning in Instruction

When carried out responsibly, cooperative learning can improve student's academic achievement and social skills (Sharan, 2010). In this era of high accountability for teachers and administrators, school districts are constantly looking for innovative ways to increase student performance on high-stakes tests. There is a national trend towards implementing research-based instructional strategies, and cooperative learning is a methodology that has been researched many times in the past (Siegel, 2005). When implemented correctly cooperative learning allows

students to construct their own learning experiences so it is directly related to the Constructivist Theory.

The *Constructivist Theory* proposes students need to become more active participants in their own learning, and when they do, they will find deeper meaning in their educational experiences (Boghossian, 2006). With the implementation of cooperative learning, a student will increase participation in the learning process, indicating the student is constructing his or her knowledge on subjective topics (Boghossian, 2006).

John Dewey, a proponent of Constructivism, was the first person to study cooperative learning as it is currently defined (Sharan, 2010). Rather than be learned by rote rehearsal or memorization, Dewey believed the knowledge students were required to learn should be integrated into daily life, leading to students working in small groups based on learning interests (Sharan, 2010).

Some of the procedures related to cooperative learning developed by Dewey include students' cooperatively planning in academic subjects and applying what they have learned to solve societal problems. In doing this, Dewey proposed, students would be prepared to participate in society as responsible adults (Sharan, 2010).

The research of Ifamuyiwa and Akinsola (2008) illuminated effects of cooperative learning versus self-learning amongst high school sophomores, emphasizing active participation and intellectual involvement of learners. Results of the study indicated cooperative learning is an effective way for students to learn mathematics. However, the self-instructional strategy was found to be more effective in improving student attitudes towards mathematics.

Sherrod, Dwyer, and Narayan (2009) examined science and mathematics integrated activities for middle school students. This study was conducted in a single Title 1 middle school in Texas. Forty percent of the student population was from low-income families. In addition, 90% of students were Hispanic, and the class consisted of 26 students: nine were female and 17 were male. The researchers concluded when students are merely sitting in the classroom, without being active participants in the learning process, there is only a transmission of knowledge through didactic lecturing (Sherrod et al., 2009). However, activities designed by the researchers allowed the students to independently and cooperatively make predictions based on their prior knowledge; students also formed conclusions

that were then supported by evidence they were able to collect (Sherrod, et al., 2009).

In 2008, Oortwijn et al. conducted a mixed-methodological study to determine whether cooperative learning increases student's math-related talks. The results indicated that students working together and helping one another increased the learning gains of the students. It is noted, however, in order for students to work cooperatively with effectiveness, they must be guided by the teacher (Oortwijn et al., 2008). Furthermore, during implementation of cooperative learning, students' interactions must be organized and structured so they are able to maximize the development of their math-related talks.

Through a qualitative study, Siegel (2005) examined an eighth grade teacher's definition of cooperative learning and how cooperative learning was integrated into lessons according to that definition. At the conclusion of the study, Siegel suggested that in order to increase student engagement and performance, teachers should adapt research-based models of instruction for their classrooms.

According to Vaughan (2002), there are positive effects of cooperative learning on achievement and attitudes among students of color. As the researcher was

measuring both attitudes and achievement of the student test group, mixed methodologies were used. The group under study consisted of 21 fifth grade students living on the island of Bermuda. There were 10 boys and 11 girls, 18 students were Black, one Indian, and two Azores. The results indicated positive gains in academic achievement, supporting the notion that cooperative learning is a preferred learning style for children of color (Vaughan, 2002). In addition, results revealed the method of cooperative learning used had positive effects on student's attitudes towards mathematics.

Theoretical Perspectives

Educators in the United States use a variety of instructional strategies to help their students learn. In the following section, the researcher will examine four theoretical frameworks that have helped shaped cooperative learning into the instructional methodology it is today.

Vygotsky developed *Socio-Cultural Theory* in the 1930s. Classified as a constructivist, his theoretical framework contributed immensely to the development of this approach (Jaramillo, 1996). The Constructivist Theory proposes that students should be active participants in their learning and as such they will find deeper meaning in their educational experiences. This participation in the learning

process indicates students are constructing their knowledge on subjective topics. As a result, knowledge acquisition for two students who had similar experiences may be quite different (Boghossian, 2006). For that reason, socio-cultural theory can be connected to social interdependence; social interdependence outlines how students are stimulated by working in groups.

Social Interdependence Theory can be traced back to the University Of Berlin School Of Gestalt Psychology in the early 1900s (Johnson & Johnson, 2009). It was during that time Kurt Lewin suggested the fundamental nature of a group results in the interdependence amongst its members. As the group functions as a dynamic whole, a change in the state of any individual group member could change the state of another group member. He further suggested members of the group are made interdependent through their common goals, causing them to work together collaboratively and cooperatively (Johnson & Johnson, 2009).

According to Piaget's *Cognitive Learning Theory* (Piaget & Inhelder, 1969), students are at the center of their learning and are able to construct new knowledge based on prior experiences. Cognitive learning theory presupposes the student is guided by intrinsic motivation, and the amount of learning that takes place is based on

what students want to achieve. Further, Piaget argued that students exposed to lectures do not receive the same brain stimuli needed to effectively learn that can be found when students engage in peer mediated instruction. He further indicated students are able to develop and organize behavior patterns quicker when interacting with their peers rather than adults (Piaget & Inhelder, 1969). This notion is echoed in the work of Havoort (2002), indicating students construct thoughts and behavior based on interactions they have with their peers, as well as by observing their peers behavior.

Motivation is a key component in student learning and achievement; motivation comes from self-regulation. Students who are self-regulated are active participants in the learning process, and have set up their own goals pertaining to learning. In addition, self-regulated learning students are also able to monitor their own activities and evaluate their own work as compared to other students, making the self-regulated learning students ideal participants for cooperative learning (Eccles & Wigfield, 2002). As mentioned within the social interdependence theory, having these types of students in a cooperative learning setting would thus increase the motivation of other students (Johnson & Johnson, 2009).

Cooperative Learning as a Methodology

Cooperative learning is a teaching methodology in which students work together in small groups that usually include no more than six students each. This method of teaching is used as a means to increase student motivation and rate of retention, while allowing students the space and opportunity to utilize critical thinking skills and encourage the participation of other students. Within these cooperative learning groups, students have a common purpose and help each other to learn the content for which the group's success is rewarded (Ozkan, 2010). Cooperative learning groups can be either heterogeneous or homogenous depending on the desired outcome of the task (Topping, 2005). A group is considered to be heterogeneous if it is comprised of students with varied academic abilities. A group is considered to be homogeneous if it is comprised of students with similar academic abilities. Whether a student is gifted or struggles with everyday learning, each student is a valuable and contributing member of the team (Topping, 2005). Typically, each of the group members would have an assigned responsibility to ensure a high level of accountability for all students (Dahley, 1994).

Elements of Cooperative Learning

Research indicates several elements are needed for successful implementation of cooperative learning, most of which are inter-related (Johnson & Johnson, 2009). For that reason, the researcher has isolated three essential components needed for cooperative learning: (a) Positive social interdependence, (b) accountability, and (c) Participation (Johnson & Johnson, 2009). Positive social interdependence is based on the notion that the success of each group member is essential for the group as a whole (Serrano & Pons, 2007). In an effort to build positive interdependence within a group, the teacher should assign grades based on the group's assessment or product as a whole. This should not be confused with combining individual grades of each group member to assign a grade to the group. The use of a reward system can also contribute to positive interdependence. This reward could be a good grade (Serrano & Pons, 2007). For self-regulating students, the reward of a good grade would be more than enough to foster appropriate levels of positive interdependence (Eccles & Wigfield, 2002).

When left to their own devices in a group setting, students would not garner the academic achievement expected from cooperative learning. Both group and individual

accountability will have an effect on the learning outcomes of the group (Serrano & Pons, 2007). One way for a teacher to increase accountability is to develop group-oriented contingencies, in which the groups' access to a reward is directly related to meeting a specific academic performance criterion. As each student will be motivated differently by different rewards, more than one type of reward should be available, and, in some respects, rewards could be combined to motivate students and increase levels of accountability (Serrano & Pons, 2007).

Participation in the cooperative learning process can be linked to high levels of accountability. Therefore, an equal level of participation amongst students is another key element to cooperative learning (Strom & Strom, 1998). In order to facilitate participation of all group members, teachers must explicitly explain that each group member is required to be an active participant in their learning, and students will be assessed by the quality of input they provide to the group as a whole (Strom & Strom, 1998).

Types of Cooperative Learning

According to Johnson, Johnson, & Smith (1998), there are two types of cooperative learning: formal and informal. *Formal Cooperative Learning* entails either a teacher-selected heterogeneous or homogenous group of students to

complete a task or assignment. In this formal set-up, the teacher acts as a facilitator, helping students to ask questions of one another and apply critical thinking skills. In addition, the teacher checks for understanding and monitors students to ensure they are on task at all times. The groupings for formal cooperative learning can vary in length, lasting a single class period to an entire semester (Johnson et al., 1998). Furthermore, assigning each student a role such as time-keeper, recorder, and reporter will help increase the levels of accountability for the group, as well as, make students more responsible for their learning (Krol, Sleegers, Veenman, & Voeten, 2008).

By definition, *Informal Cooperative Learning* is somewhat less structured than formal cooperative learning. Informal cooperative groups can be either teacher selected groups or student selected groups. The selection of the groups is not critical, as group tasks will not necessarily include a product that will be assigned a grade. Within an informal group, the teacher may pose a question to the entire class, and then have students reflect or discuss the question within groups of two or three students. Typically, this discussion will only last a few minutes, and then the teacher will pull the class back together. Whether the

group is formal or informal, the teacher may have group members report group information to the rest of the class (Johnson et al., 1998).

Approaches to Cooperative Learning

Since research began on cooperative learning many decades ago, several approaches to cooperative learning have been developed over time. For the purpose of this paper, the researcher will focus on the five (See Table 1) most researched and implemented approaches to cooperative learning in schools across the United States and abroad. As you will see from the table, the first of five approaches that will be discussed is known as *Jigsaw* (Aronson, Blaney, Sikes, Stephan, & Snapp, 1978).

With the jigsaw approach, cooperative learning students are placed in six-member groups. The material the group is to work on is divided into five sections, requiring two students to work together on one section (Slavin, 1982). The other four group members are each assigned a single section of material on which they are to read and become an expert. Once groups have completed their tasks, each group member meets with members from the other groups to discuss what they discovered (Slavin, 1982). Once students have met with members of other groups, they all return to their original groupings. Upon reconvening with

original groups, members share what they have learned by meeting with members of other groups. Utilizing this approach allows each student to take on the role of teacher and share their learning (Aronson et al., 1978; Slavin, 1982). However, the classroom teacher must constantly monitor all groups to ensure students are working and completing assigned tasks (Knight & Bohlmeyer, 1990). While students are working in groups, the teacher will rotate and instruct small homogenous groups of students. Each day, the teacher works with a different group of students to assist with activating prior knowledge in preparation for learning what is to come in future lessons (Slavin, 1995). A system of rewards is used to provide students with the motivation needed to proceed through the materials (Slavin, 1983). Throughout this time, there are to be checks for understanding made by the teacher; doing so ensures time is not wasted on material students have already mastered (Slavin, 1995).

Sharan and Sharan (1989) established another form of cooperative learning, *Group Investigation* (GI). This approach has six stages of implementation. In the first stage, the teacher must identify the topic, present it to the students, and begin to divide the students into groups.

Table 1

Approaches to Cooperative Learning

Jigsaw	Team Assisted Individualization	Group Investigation	Student Teams-Achievement Divisions	Learning Together
Students placed in groups of six; material divided into five sections.	Heterogeneous groups of four to five students.	Topic identified by teacher and given to students.	Group discussion that is teacher-led.	Groups of up to five students.
Each student is responsible for a single section; excepting a single pair of students responsible for a section.	Assignments are individualized and students must employ self-management.	Student groups meet and develop an action plan. Each student given a specific task.	Students set in heterogeneous teams of four to five.	Each group member is given a specific task to complete.
Collaborate with other groups to learn their respective sections of the	Teacher roves amongst the groups and checks for understanding.	Plan is implemented and students carry out research.	Students study new material in groups; work out problems and quiz one another.	Students work on each task independently, though the entire process is facilitated by the teacher.
Students return to original groups for share-out.	Students are provided with rewards as a mean of extrinsic motivation for good performance.	Data is compiled and a final product is developed and presented to the class.	Take independent quizzes and attempt to increase their individual improvement score.	Students' come together to assemble their individual tasks into a final product.
		Assessment is created, which is student driven.	Student's individual score is applied towards the group score, which is based on how much their average quiz score increased from the preceding quiz.	Students are graded individually based upon how much they contributed to the group.

In order to elicit various responses and reaction from students, it is imperative for the topic of inquiry to be multifaceted (Sharan & Sharan, 1989). Next, students convene with the groups to which they have been assigned, and formulate an action plan to execute their research. The plan includes deciding which group member will perform a given activity, as well as what tools will be needed to carry out their research; one group member will be designated as the facilitator and will guide the group throughout their inquiry (Sharan & Sharan, 1989).

During the third stage, students are to implement the plan they developed in stage two and carry out their research. It is recommended each group member report out his or her progress and what has been discovered; this increases the level of accountability among the entire group. In stage four, students begin to compile their individual work into a final report and decide what materials will be needed for their final group presentation to the class (Sharan & Sharan, 1989). Once each group has a final product with which they are satisfied, groups are ready to complete stage five: presenting their final product to the class (Sharan & Sharan, 1989).

In stage five, the presenting group takes on the role of teacher, providing a lesson to their classmates based on

what they have learned in their research. The sixth and final stage culminates with evaluation (Sharan & Sharan, 1989). Due to the nature of the inquiry, students are constantly being evaluated by their peers and teacher; however, the formal evaluation is an assessment developed by the entire class. Each group of students develops two to three questions to be included on the final exam, and students are expected to answer all question with the exception of those they submitted (Sharan & Sharan, 1989). To ensure groups do not answer questions they submitted, the teacher is responsible for compiling the questions on the exam. In addition, students should be able to reflect either in writing or discussion what they learned during the process, as well as, how this type of project affected their learning (Sharan, 1990).

Student Teams-Achievement Divisions (STAD), developed by Robert Slavin and National Education Association [NEA] (1991), have five basic components: class presentations, curriculum materials, teams, individual improvement scores, and team recognition. The first component is a group discussion with the class led by the teacher. Once lecture has been completed, students are divided into heterogeneous groups of four to five students (Slavin & NEA, 1991). In their groups, students are to study new material they have

learned, work out problems in pairs, and take turns quizzing one another (Slavin & NEA, 1995). The purpose of this type of learning is to give students the opportunity to review information they have learned, discuss it with their peers, and develop a thorough understanding of the information (Slavin & NEA, 1991). Once students believe they have mastered a particular concept, they are then given a quiz. The quizzes are completed independently; however, each individual score will contribute to the overall score of the group (Slavin, 1995). The amount of points one student's individual score is applied towards the group score is based on how much his or her average quiz score increased from the preceding quiz. This basis for points allows all team members an opportunity to contribute to the group, and groups that score well receive recognition from the teacher, which could be as simple as a classroom newsletter sharing names of students who improved most as a group (Slavin, 2006).

As students find comfort in this type of learning environment, they begin to take ownership of their learning experience (Slavin & NEA, 1991). While students may look to the teacher as a resource when they find themselves stuck, the teacher's role is one more aligned to that of a coach rather than to a boss (Slavin, 1995). As such, students are

able to build camaraderie with each other, finding themselves going to their peers who may better understand a concept and know the answer; rather than resenting said peer as a 'know-it-all' (Slavin & NEA, 1991).

Learning Together is another cooperative learning approach that involves placing students in heterogeneous groups with up to five students (Johnson, Johnson, & Stanne 2000). The group is given an assignment, and each individual group member is assigned a task (Johnson et al., 2000). Students work independently on their respective portion of the assignment, while the teacher takes on the role of facilitator (Johnson et al., 2000). Once each student has completed his or her individual task, students come together to create one final product to submit for a grade. Students' are then graded based on individual contributions to the assignment (Johnson & Johnson, 1994).

Benefits of Cooperative Learning

There are many benefits to implementing cooperative learning in classrooms. One such benefit is students developing a positive attitude towards learning. Students who work in a collaborative social setting will lower their affective filter and be more responsive to teaching and learning; thus, increasing their level of achievement (Panitz, 1999). As students recognize their successes in

learning, their motivation to perform well will increase; students who excel in academics want to continue to excel. In addition to a change in attitude towards learning, students' self-esteem will increase because they will see themselves as successful student learners (Panitz, 1999).

Students who are performing at higher levels can also serve as role models and tutors for their peers who may be struggling. Implementing a process in which a student who understands a concept being taught assists a peer who is struggling can boast the esteem of both students (Panitz, 1999). This method of learning is especially critical for learners of culturally diverse learners. Typically, students from diverse backgrounds who are in competitive classroom settings have lower self-esteem. When students with low self-esteem are removed from a competitive learning environment, they are more likely to encourage one another, which can increase their achievement (Manning & Lucking, 1993). According to Manning and Lucking (1993), students from culturally diverse backgrounds tend to have low self-esteem when they are the minority in a classroom. In addition, their levels of academic success are low compared to their peers who are not from culturally diverse background, further aggravating the already sagging self-esteem Both African-American and Mexican-American students

have demonstrated increased levels of academic achievement in cooperative learning environments (Manning & Lucking, 1993).

As active participants in the learning process, students take ownership of their education and are determined to work with their peers towards a common goal where they can all find success. This idea is especially important for those students who have struggled in the past (Panitz, 1999). The success of the students increases their satisfaction with school; this high level of satisfaction will increase student engagement and decrease off-task behavior (Panitz, 1999). It has also been noted that cooperative learning decreases student anxiety while learning new concepts (Panitz, 1999). In a traditional classroom set-up, students are called on individually and may be embarrassed if they answer incorrectly. However, in a group situation, they are surrounded by just a few of their peers, where they will not be put on the spot. Furthermore, the group has an opportunity to review their work before it is presented to the rest of the learning community in the classroom. This review will diminish the likelihood that a student makes a mistake, which, in turn, can increase student levels of independence (Panitz, 1999).

Implementing cooperative learning classrooms can also assist in developing student social skills. By being placed in a group setting, students will develop skills they need to work cooperatively and collaboratively with those who are different from them. This will help students not only in the school environment, but also as adults who will be living and working in diverse communities. Moreover, students who engage in cooperative learning are able to engage in polite societal repartee, which could help reduce the inclination towards violence in other settings and situations (Panitz, 1999).

The use of cooperative learning can also help improve school wide positive behavior (Panitz, 1999). This occurs because teachers begin to learn more about student behavior since cooperative learning lends it self to open communication with the teacher so students are able to articulate their actions and thoughts as it relates to their behavior (Panitz, 199). Additionally, the teacher is able to discuss with students why certain policies need to be enforced and students can become involved with developing rules and policies. When students take an active rule in developing rules and policies they then have a vested interest and are more likely to adhere to them, in addition they will hold their peers accountable to the

rules. Students will not only be invested in their learning, but they will take pride and ownership of the entire school community (Panitz, 1999).

By engaging in cooperative learning, students will be able to challenge ideas and advocate for their positions without personalizing their statements or putting down others. Furthermore, their increased social skills and sense of others will allow them to resolve their differences amicably (Panitz, 1999). Lastly, cooperative learning is a low-cost way to increase student achievement. In this era of budget cuts and lack of funding, teachers can easily implement these strategies with little or no fiscal impact (Hendrix, 1996). The only cost is the time it takes for the teacher to design and implement this new teaching style. Based on the information available, cooperative learning appears to be a great opportunity for students to become more actively engaged in their learning. Unfortunately, there are some drawbacks to cooperative learning.

Drawbacks to Cooperative Learning

Though there is research available to outline how students may benefit from participating in cooperative learning, there are some drawbacks one must consider. In order for cooperative learning to be effective, the teacher

must relinquish a great deal control over the class. This is a concern for large classes in upper grades. In addition, the noise levels of classrooms engaged in cooperative learning will be considerably higher than in a classroom where instruction is primarily delivered via lecture (Cooper, 1995).

Those who are not confident in the use of cooperative learning are also concerned with the *Hitch Hiker* problem. This occurs when a member of the group does not do his or her fair share of work and leans on the other group members, which may cause resentment of those putting forth a great deal of effort to be successful (Cooper, 1995). Another possible drawback to cooperative learning is widespread implementation by teachers who do not fully understand the process. Their lack of information on implementing the approach could result in student failure and frustration (Slavin, 1989). However, some research has indicated negative consequences a teacher may encounter with implementing cooperative learning may be alleviated if teachers are adequately trained and the correct approach of cooperative learning is implemented (Slavin, 1989).

Cooperative Learning in Mathematics

Krol, Janssen, Veenman & Van der Linden (2004) conducted a study to determine the efficacy of cooperative

learning in mathematics. The participants consisted of nine third grade classes from three different elementary schools in Frankfurt, Germany, totaling 208 students. Of the students who participated in the study, 108 were female and 100 were male; the average age was nine. The results were promising, indicating a positive correlation between the use of cooperative learning and mathematics achievement. However, it should be noted the research did reveal it is necessary for younger students to be provided with the support and guidance throughout this process. The support is needed to assist students coping with challenges they may encounter by having to independently prepare and present information to their peers (Krol et al., 2004).

Isik and Tarim (2009) examined the effects of cooperative learning methodology in mathematics on a group of students from one school in Turkey. There were 150 participants from four different fourth grade classes. The students were divided equally into a control group and an experimental group. The researchers designed the mathematics achievement test, which was used for pre- and post- tests, as well as a retention test for both the control group and the experimental group (Isik & Tarim, 2009). When compared to the results of the control group, which did not score as well on the mathematics achievement

test, results indicated cooperative learning was statistically effective when implemented. Moreover, if students are exposed to cooperative learning for a long period of time there is an increase in academic achievement; thus, cooperative learning increases academic performance in the long term. For those reasons, students should be working in cooperative groups for an entire semester, versus a single class period, so their rate of retention will increase (Isik & Tarim, 2009).

In some instances, mathematics can be successfully integrated into other subjects, such as science, with the use of cooperative learning (Sherrod et al., 2009). Sherrod et al. (2009) designed activities that allowed students to cooperatively make decisions based on their prior knowledge, allowing students to be both scientists and mathematicians in calculating and analyzing data. Students kept accurate records of their observations because they knew this information would be presented to their peers (Sherrod et al., 2009).

Cooperative learning nurtures an environment that enhances students' ability to construct a more comprehensive understanding of mathematics and science, allowing them to transfer their skills into the real-world. In addition, using presentations as an assessment method

encouraged students to further develop their communication and argumentation skills (Sherrod et al., 2009).

Krol, et al. (2004) corroborated the notion that students who work in cooperative groups for mathematics demonstrate high levels of interaction and use of academic language. Their findings also indicated characteristics of tasks can effect interaction between students. The study suggested that when working on mathematics in cooperative groups, 75% of students' utterances were cognitive statements related the lesson; in addition, students demonstrated higher-order thinking skills during this time. This suggests when cooperative learning tasks are well thought out and effectively planned there is optimal student engagement. Furthermore, students who engaged in cooperative learning reported they are more likely to want to work collaboratively on a task or assignment in the future; this idea was contrary to the control group (Krol et al., 2004).

A case study conducted in Southwest Nigeria by Kalder (2007) offered information on the effects of cooperative learning versus competitive learning in secondary mathematics. Pre- and post- tests were used to gauge student achievement between the control group and the experimental group. The results indicated students who were

taught using cooperative learning methods had significantly higher achievement in mathematics than those students who were taught in the more traditional competitive manner (Kalder, 2007).

Another study of cooperative learning in secondary mathematics was conducted by Adesoji & Adesoji (2007). The duo chose the *Learning Together* approach to determine the effects of cooperative learning. The experimental group consisted of 35 students, as did the control group. The control group was taught using traditional teaching strategies, which included lecture as the primary method of lesson delivery (Adesoji & Adesoji, 2007). Both groups were given a pre-test to determine a baseline of performance. After the treatment, a post-test was given and data indicated students who engaged in the cooperative learning process scored markedly superior than students in the control group who were taught with traditional strategies (Adesoji & Adesoji, 2007).

Summary

Federal legislation is changing the face of education with laws such as NCLB and IDEA, which is forcing educators to examine their current teaching practices. This chapter covered issues related to instruction such as learning styles theories, multiple intelligences, and new

educational movements such as RtI^2. In addition, historical and theoretical frameworks of teaching as it relates to cooperative learning was discussed and it seems that both past and current literature presented in this chapter indicate that cooperative learning has positive effects on students' social skills, self confidence, and academic achievement (Sharan, 2010).

In addition, increased social skills provide students with the ability to more easily solve disagreements with their peers (Panitz, 1999). Most importantly, research has shown using cooperative learning not only increases the academic achievement of students from culturally diverse backgrounds but also cooperative learning is the preferred method of learning for students from diverse backgrounds (Manning & Lucking, 1993). The United States has become an amalgamation of people from all over the world making it a diverse country with ever-changing demographics (Hardy, 2004). For that reason, it is imperative for educators and school administrators to implement researched-based instructional practices that support all students and their instructional needs. Increasingly, educational reform in the United States is focusing on building competent thinkers who are able to utilize their skills in mathematics. Therefore, ensuring teachers and students have

the instructional strategies that will increase student achievement and knowledge is tantamount. In the following chapter, the research will discuss the design of the research study.

Chapter 3

Research Design

Introduction

The purpose of this chapter is to describe the research design and procedures that were used to answer the research question presented in Chapter 1. The research question to be answered was the following: "How would 56 students in two ninth grade Algebra I classes, taught using cooperative learning method on a comprehensive high school campus in South Los Angeles, score on the Periodic Assessment as compared to 57 of their peers in two separate Algebra I classes at the same school that were not taught using cooperative learning methodologies?" In the following pages of this chapter, the researcher will discuss the research plan, setting, data gathering methods and procedures, ethical considerations, data analysis, and provide a summary of the chapter.

The research of Gardner (1983/1993) on learning styles theory discusses how students acquire knowledge in different ways. Understanding the way students learn best is helpful for teachers so that they are able to make learning more meaningful. Cooperative learning is a unique instructional methodology because when it is effectively utilized, it maximizes all learning styles (Ozkan, 2010).

The findings of Sousa (2005) indicated that 24 hours after learning a concept, the average student will only retain 20% of the information if it was delivered via audio-visual, such as a lecture with notes presented on the board. When a concept is demonstrated to students, the retention rate increases to 30%; however, when a student is given the opportunity to actually practice a concept the retention rate increases to 75%. Cooperative learning allows for students to be active participants in their own learning (Sousa, 2005) so they will be able to practice what they are learning. This should increase their retention rate and thereby increase their scores on district and state assessments; therefore, the researcher attempted to provide evidence that the use of cooperative learning instruction would improve students' acquisition of Algebra I.

The research design included reviewing student assessment data after teachers have taught students Algebra I using cooperative learning instruction. The researcher then compared the assessment results of students who were taught using traditional teaching methodologies to those scores of students who were taught using cooperative learning. The rationale for this research was to determine if the implementation of cooperative learning instruction

in Algebra I increased student scores on standardized assessments.

Study Design

According to Slavin (2006), experimental research is defined as a researcher's desire to control and manipulate various variables in an experimental method. In this study, the researcher performed a quantitative study of ex-post facto data. The statistical test used the students' 2009-2010 scores on the Mathematics Periodic Assessments as a covariate to determine statistical differences from the 2010-2011 Mathematics Periodic Assessment scores. This allowed the researcher to understand any aptitude differences that may exist among the control and experimental groups.

The independent variable was the classroom where the teachers implemented cooperative learning methodologies. This group consisted of two ninth grade Algebra I classes, Class I and II, which participated in jigsaw, Group Investigation (GI), and Learning Together (LT); the two teachers implemented these approaches to cooperative learning in their Algebra I classes on a daily basis. The control group consisted of two other ninth grade Algebra I classes, Class III and IV, in which teachers did not implement any cooperative learning strategies. The teachers

of the control group continued to use traditional learning instead of cooperative learning on a daily basis in their Algebra I classes. The researcher used a *Nonequivalent Control-Group* design, which means that the groups are naturally occurring in the classroom environment. However, they are chosen so that they are as similar as possible. Slavin (2006) indicated that researchers cannot randomly assign subjects to treatment groups in educational classroom settings, which is why *Nonequivalent Control-Group* design needs to be a consideration.

For this study, the researcher chose the experimental and control groups based on the experience and training of the teachers. The two teachers who implemented cooperative learning had participated in a professional development emphasizing the use and implementation of Cooperative Learning in Algebra I. Therefore, these teachers' classes comprised the treatment group.

The researcher examined the data from the eighth grade Mathematics Periodic Assessment, which served as the pre-test. The ninth grade Algebra Periodic Assessment served as the post-test in this research study. By analyzing the eighth grade Periodic Assessment data, the researcher was able to determine the equivalence of the treatment and control groups. Slavin (2006) indicated that the use of a

pre-test eliminates an internal validity threat due to the non-randomization of subjects. Non-randomization can present superfluous variables such as the differences in aptitude between the treatment and control groups. Therefore, the researcher utilized the eighth grade Mathematics Periodic Assessment scores in an analysis of variance (ANOVA) to statistically adjust the post-test score for the pre-test differences.

Setting

The school from which the researcher analyzed data is a small urban high school located in South Los Angeles, where the total student population is 1,627 students. As indicated in Table 2, there is limited diversity among the student population enrolled at the high school, including race, gender, and English proficiency. There are only two ethnic groups that attend the school. The largest group, Latino, attributes 56% of the total population with the remaining 42% being African American. Though there is a large Latino population, only 19% of the student population consisted of students who have Limited English Proficiency (LEP). This means that most ELL students are re-designated as English Proficient by the time they enter high school.

Participants

The four Algebra I classes in which the researcher analyzed data consisted of approximately 35 students each with a total of 113 participants.

Table 2

School Demographics

Grade Level	Enrollment	Ethnicity	#	%	Limited English Proficiency	%
Grade 9	407	Latino	943	56	309	19
Grade 10	456	African-American	684	42		
Grade 11	441					
Grade 12	323					
Total	1,627					

Four teachers participated in the study. They were all in the early stage of their careers with each having between 5 to 7 years of experience. All of the teachers were highly-qualified, as indicated by No-Child Left Behind (NCLB), and had performed their jobs with satisfactory or better evaluations. Of the four teachers, two were selected to receive professional development during the fall of 2010 on the effective use of cooperative learning with the directive to implement cooperative learning methods in their classrooms during the spring 2011 semester.

The students whose data was examined in this study were all ninth grade Algebra I students who were part of the general education program. In general, students in the class were freshman taking Algebra I for the first time. However, there were students who took Algebra I in eighth grade who earned a grade of D or F and could not continue on to geometry. Historically, very few ninth grade Algebra I students at Bright Futures High School score are at the proficient level on the California Standards Test (CST). During the 2009-2010 school year only 7% of ninth grade students were proficient in Algebra. This is the reason this group was selected for the study. Additionally, the Algebra I standards taught in this course will be presented to the students once again in the tenth grade when they take the CAHSEE.

Human Subjects Consideration

The data used in this study was archived data that was obtained from central office records and no live students were involved in the testing in anyway. This research was conducted in an established educational settings, involving traditional educational practices. No students were observed, interviewed, or questioned in any way related to this study. There were no potential risks for students participating in this study as there was no change to their

educational program. This study was exempt as indicated by the Institutional Review Board (IRB)criteria.

To guarantee confidentiality, student names were not used during the course of data collection. Instead, each student was identified by their district assigned student identification number in lieu of their name. This enabled the researcher to match the results of the pre-tests and post-tests. A master list with student data is kept at the researcher's home in a locked filing cabinet for the duration of the study. At the conclusion of the study, the master list containing students' scores and identification numbers will be maintained in a locked cabinent for a period of 3 years, and then destroyed.

The list was necessary to ensure that only students who took the post-test could be matched to the appropriate pre-test scores. If a student opted out of the study before the post-test, the pre-test corresponding to that student was not analyzed in the data results. Upon request, all study participants parties will receive a final copy of the results of this study.

Instrumentation

The instrumentation used in this study was the Mathematics Periodic Assessment; this assessment is a summative assessment whose test questions are similar to

those found on the California Standards Test (CST). The CST and Periodic Assessment appraise whether a student has mastered the specific standards for each subject in a particular grade level. Since the test is designed to gauge what a student has learned, it is a criterion referenced test. It is used as a diagnostic tool by teachers to determine how students are performing in preparation for the CST. Classroom teachers administered the assessments at the behest of the Board of Education of the Promising Future Unified School District.

Instrument Validity

The Mathematics Periodic Assessment appraises whether a student has mastered the specific standards for each subject in a particular grade level. Since the test is designed to gauge what a student has learned, it was used as a criterion referenced test. A criterion-referenced test was appropriate for this study because it measured the academic achievement of each student in the school who took Algebra I. According to the California Department of Education (2009), the test contains test items that are categorized with varying levels of complexity from low to high. This is done in an effort to ensure students will have a variety of items with varying levels of difficulty. An item with a low level of complexity may require a

student to use a simple skill such as solving a two-step problem linear equation, while an item of medium level of complexity may require the student taker to solve a quadratic equation requiring several steps. When presented with an item with a high level of complexity the student may be required to justify the answer to an Algebra I problem.

Another component of determining instrument validity of the instrument is field testing. Field testing on items occurs on an on-going basis; however, after a specific item has been field tested the test developers' check the question's item difficulty level. Item difficulty refers to the percentage of students who actually chose the correct answer when the question was field tested (California Department of Education, 2009). The larger the percentages of students who answer the question correctly, the easier the test developers consider that question. For example, if over 70% of students answer a question correctly, then test developers consider that test question as easy. Whereas, developers consider test questions difficult if less than 40% of students answer the question correctly. Next, test developers assign test item difficulty as a p-value. Having a range of item difficulties allow for the formation of a

scale of student achievement, which is far below basic, below basic, basic, proficient, and advanced.

Instrument Reliability

All California Standards Tests in each content area follow an intensive reliability process from test question construction to statistical analysis. The steps involved: item writing, pilot testing, committee reviews, field testing, statistical review, test construction, operational testing, and item release or use. The California Department of Education (2009) only used field test questions that are statistically sound and met a quality assurance measure. During the process of test construction and after test administration, test developers measured overall test reliability such as the standard error of measurement. In addition, once field testing concluded, a statistical analysis was conducted on the test items several times to ensure assessments have a high agreement coefficient as measured by Cronbach's alpha (California Department of Education, 2009). 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 (California Department of Education, 2009).

Data Gathering Methods

Outlined below are the data gathering methods and procedures that the researcher used. Since this was a quantitative study of ex-post facto data, the researcher reviewed assessment data from the 2009-2010 school year and the 2010-2011 school years. The methods relate to the variable in specific ways, which are outlined as follows.

Assessment. As directed by the instructional policies of the district, teachers administered a periodic assessment, whose results are published on the district's website. The researcher analyzed and used the eighth grade Periodic Assessment scores from the 2009-2010 school year as a pre-test. The post-test was in the form of the district Periodic Assessment from the 2010-2011 school year. The tests were given a numerical value related to student progress and that make their achievement observable and measurable. The type of data obtained were raw scores, which were used to determine whether students' achievement improved when compared to their eighth grade Periodic Assessment scores. In addition, the scores between the experimental and control group were analyzed to determine if students whose teachers implemented cooperative learning strategies achieved higher scores on the periodic

assessment than those students whose teachers did not implement cooperative learning methodologies.

Descriptive statistical analysis. The researcher reviewed and analyzed student Periodic Assessment results from the previous school year. This served as a pre-test to establish baseline data to see how well students were performing at this time of the school year. In addition, the scores were used as a covariate to determine statistical differences from the 2009-2010 Mathematics Periodic Assessment scores.

The alignment chart, which can be seen in Table 3, displays information related to the data gathering methods. It illustrates the design integrity of the study by outlining the data gathering method, when they were done and at what time intervals.

Procedures

Two ninth grade Algebra I teachers at Bright Futures High School were selected to receive training to implement cooperative learning methods in their classrooms. They received training during the fall of 2010 with the expectation that they would implement those strategies in their classes at the onset of the spring semester in February 2011. The teachers implemented jigsaw, group

investigation, and learning together methods of cooperative learning in all lessons. The approach to cooperative learning varied based on the lesson being taught each day. The other two Algebra I teachers at the school did not receive training in the implementation of cooperative learning methods. As a result, they continued teaching their lessons using traditional methods, which includes direct instruction and lecture.

Since education takes on the characteristics of a community event during cooperative learning, teachers who implemented cooperative learning had to provide explicit instruction on the Community Learning Behaviors (CLB) they expected of the students during lesson time. The teachers developed the CBLs with a generous amount of input from the students. By allowing the students to decide what were important components in their learning was a way to get them invested in what they would be doing, and hold one another accountable.

Table 3

Alignment Chart

Purposes as related to the study's question	Data Gathering Method	Timing	Type of Data Collected	Key Questions
Determine how well students performed on eighth grade assessment.	Analysis of periodic assessments from the 2009-2010 school year.	February 2011	Student scores on previous Mathematics periodic assessments.	Is there equivalence of the treatment and control groups
Determine students' willingness to work in cooperative groups for problem solving.	Mathematics Periodic Assessment	June 2011	Criterion referenced assessment that will gauge student achievement on the Mathematics periodic assessment.	Is there appears to be a relationship between the use of cooperative learning and student achievement

These CBLs took the place of typical classroom rules and included items such as respecting the thoughts and opinions of others, allowing and encouraging the participation of all group members, and being comfortable taking risks without the fear of ridicule. By front loading the students with this information the teachers were able to set the tone as to how they would guide the class with cooperative leaning for the remainder of the semester.

The researcher examined existing student data that included their scores from the eighth grade Mathematics Periodic Assessment, which served as a pre-test. In mid-April all Algebra I students at Bright Futures High School took a periodic assessment, which is used as a diagnostic tool by teachers to determine how students are performing in preparation for the California Standards Test. The assessments were administered by classroom teachers at the behest of the Board of Education of the Promising Future Unified School District.

According to Ary, Jacobs, Razavieh, & Sorenson (2006), if there were no significant differences on the pre-test, it is possible for the researcher to eliminate selection as a threat to internal validity. If there were some differences, then an ANOVA would have statistically adjusted the post-test scores. The researcher used the ninth grade Algebra I Periodic Assessment from the 2010-2011 school year as a post-test to discern any differences of scores amongst the two groups of students.

Data Analysis

The researcher reviewed student Periodic Assessment results from the 2009-2010 school year. This served as a pre-test to establish baseline data to see how well students were performing at this time of the school year as

compared to how they well they scored on the assessment from the 2010-2011 school year. In addition, the scores were used as a covariate to determine statistical differences from the 2009-2010 Mathematics Periodic Assessment scores, which were used to determine if there are any gains in student achievement on the assessments. He then compared these score to the Periodic Assessment data from the current school year and was able to draw certain conclusions. By comparing the scores of previous periodic assessments the researcher was able to determine if there were gains in student scores after cooperative learning was implemented.

Once the data was gathered, there were many ways in which it was disaggregated. To begin, the researcher compared the pre and post scores of the two different groups of students to discern if there were any trends amongst the students who were taught using cooperative learning methods to those who were taught using traditional methodologies. In addition, he examined the scores of students who are English Language Learners in the groups to determine what conclusions, if any, could be drawn between the control and experimental groups.

Summary

This chapter has presented the design of this research study, which took place in an urban high school located in South Los Angeles. This was a quantitative study of ex post data. Permission to conduct this study was obtained from the Promising Future Unified School District to determine, "How would 56 students in two ninth grade Algebra I classes, taught using cooperative learning method on a comprehensive high school campus in South Los Angeles, score on the Periodic Assessment as compared to 57 of their peers in two separate Algebra I classes at the same school that were not taught using cooperative learning methodologies?" The study was comprised approximately 113 ninth grade students that are enrolled in Algebra I classes. The researcher was able to ensure that students' confidentiality was maintained throughout this research. Instead of names, students were indentified through unique identification numbers. Quantitative data was collected, by Promising Future Unified School District, in the form of standardized tests. These tests were administered by the classroom teacher under the direction of the board of education. The following chapter will discuss the results of the research study.

Chapter Four

Data Analysis and Findings

Introduction

The purpose of this study was to determine the effects of cooperative learning on student achievement in the subject area of Algebra I. The study was conducted within four, ninth grade Algebra I classes on a South Los Angeles high school campus. The total population of the school site includes 1,700 students. Of the total student population, 113 (6%) students participated in the study. The researcher conducted a quantitative ex-post facto study and utilized descriptive statistical analysis as a means to review previous student standardized test scores. The information allowed the researcher to determine a baseline performance and chart growth over 1 year, one group of students was taught using cooperative learning methods, while another group was taught using traditional methods of teaching.

This study was designed to (a) inform classroom teachers of the benefits of implementing cooperative learning methods in their classrooms, and (b) answer the research question, "How would 56 students in two ninth grade Algebra I classes, taught using cooperative learning method on a comprehensive high school campus in South Los

Angeles, score on the Periodic Assessment as compared to 57 of their peers in two separate Algebra I classes at the same school that were not taught using cooperative learning methodologies?"

Participants

The students whose data were analyzed in this study were all ninth grade Algebra I students and integrated into the general education program. Historically, few ninth grade Algebra I students at Bright Futures High School have scored at the proficient level, a score of 350 or higher, on the California Standards Test (CST). For that reason, this group was selected for the study. Additionally, the Algebra I standards taught in that course will be presented to the students once again in the tenth grade when they take the California High School Exit Exam (CAHSEE).

As indicated in Tables 4 and 5, there was limited diversity among the student population enrolled at Bright Futures High School. Within this group of students there were not a significant number of students with Limited English Proficiency (LEP). The demographics of the students who were enrolled in the classroom where cooperative learning was used are as follows: African Americans (30), Latino (26; of which 15 were Limited English proficient). In this group of students, five were identified as

receiving special education services, one student was designated as gifted, and 56 are considered socio/economically disadvantaged (i.e. Title I), which means one student was not from a low-income family. A total of 56 students were taught using cooperative learning methods.

Table 4

Classroom Demographics-Cooperative Learning

	African American	Latino	LEP	SPED	Gifted	Socio/ economically Disadvantaged
Male	16(29%)	13(50%)	6(11%)	3(5%)	1(1%)	27
Female	14(25%)	13(50%)	9(16%)	2(3%)	0	28
Total	30	26	15	5	1	55

There were 57 students who received their instruction through traditional methods. This group of students consisted of 25 African American and 32 Latino, of which, 14 were Limited English Proficiency. There were no gifted students in this group, while seven were indentified as special education, and 53 were considered socio/economically disadvantaged.

Table 5

Classroom Demographics-Traditional

	African American	Latino	LEP	SPED	Gifted	Socio/economically Disadvantaged
Male	12(21%)	20(35%)	8(14%)	4(7%)	0	30(53%)
Female	13(23%)	12(21%)	6(9%)	3(5%)	0	23(40%)
Total	25	32	14	7	0	53

Research Instruments

The tools used to gather student achievement data was the Mathematics Periodic Assessment, which is a summative assessment whose test questions are similar to those found on the California Standards Test (CST). The CST and Periodic Assessment appraise whether a student has mastered the specific standards for each subject in a particular grade level. Since the test is designed to gauge what a student has learned, it is a criterion referenced test. A criterion-referenced test was appropriate for this study because it measured the academic achievement of each student in the school that has taken Algebra I. The tools were considered to be valid and reliable because the CST in each content area follows an intensive reliability process from test question construction to statistical analysis. The steps involved: item writing, pilot testing, committee reviews, field testing, statistical review, test construction, operational testing, and item release or use. The California Department of Education (2009) only uses field test questions that are statistically sound; these items must pass a quality assurance measure. During the process of test construction and after test administration, test developers measure overall test reliability such as the standard error of measurement.

Data Analysis

Data consisted of raw scores from the periodic assessments from the 2009-2010 school year and the 2010-2011 school year. The raw scores from each test were entered into the NCSS Statistical Software Program. The researcher employed a *t* test for two independent variables with an independent measure design between subjects. The *t* test for two independent variables was employed to determine if a statistical difference in achievement in Algebra I existed between the growth of the students who were taught using cooperative learning and control group. Descriptive statistics including means, standard deviations, range and mode, were computed and presented for each group. An alpha level of .05 was used for the analysis.

The researcher used a convenience sample due to the participants having been randomly assigned to classes at the beginning of the school year. The treatment group had 56 students (*n* =56), while the control group consisted of 57 students (n=57). The average pre-test and post-test scores of the experimental group and control groups, as well as the average difference between the two groups are shown in Table 6. The table shows the information obtained from the *t* test, which analyzed the difference in pre-test

and post-test scores. The mean pre-test score for the experimental group was 257 (*M*=257, *SD*=20.76), while their post-test mean score was 266 (*M*=267, *SD*=31.88). The average gain in scaled scored was nine points. The mean pre-test score for the control group was 253 (*M*=253, *SD*=26.51), in this same group the mean score on the post-test was 252.08 (*M*=252, *SD*=22.14). The average gain from pre-test to post-test for the control group was one point.

Table 6

Periodic Assessment Pre-test/Post-test Scores

	Pre-test		Post test		Difference
Group	M	Σ	M	σ	M
Experimental (n=57)	257	20.76	267	31.88	9
Range	100		148		
Mode	247		251		
Control (n=56)	253	26.51	252	22.14	1
Range	136		108		
Mode	239		258		

Baseline Data

The researcher examined the data from the eighth grade Mathematics Periodic Assessment, which served as the pre-test. The ninth grade Algebra I Periodic Assessment was the post-test in this research study. By analyzing the eighth grade Periodic Assessment data, the researcher was able to determine the equivalence of the treatment and control

groups. Slavin (2006) indicated that the use of a pre-test eliminates an internal threat of validity due to the non-randomization of subjects.

Starting with the control group, which were the students taught with traditional methods, the researcher analyzed their performance levels on the eighth grade Mathematics Periodic Assessment that was given in April of the 2009-2010 school year. There were 57 students who were taught using traditional methods. Their baseline data, which is also located on Table 6, indicates that the majority of the students scored either far below basic (28) or below basic (28) with only one student scoring at the basic level and zero students scoring at the level of proficiency or advanced. The baseline data for the experimental group mirrored the control group. There were 26 students who scored far below basic, 29 who were below basic and only one student that was basic. Additionally, there were no students who scored at proficient or advanced levels.

Findings

Traditional methods. After analyzing the data from the 2010-2011 Periodic Assessment in Algebra I, there was no significant increase in performance among those students

who were taught using traditional methods. At the onset of the study, there were 28 students who scored far below

Table 7

Baseline Data

Performance Level	Scaled Score	Traditional-09/10	Cooperative Learning-09/10
Advanced	428-600	0	0
Proficient	350-427	0	0
Basic	300-349	1	1
Below Basic	253-299	28	29
Far Below Basic	150-252	28	26
	Total	57	56

basic; after the study, there were 32 students who scored far below basic. Within the control group, nine students' scaled scores increased, but not enough to move them into the basic level. Eight of the students who scored far below basic had a decrease in their scaled scores. Though the above results are somewhat disheartening, there was growth in student achievement. Nine students increased their scaled scores enough to move from far below basic to below basic and one student made a significant gain from the level of far below basic to basic. Unfortunately, there were 15 students whose scaled scores decreased, as did their performance level. Therefore, they moved from below basic to far below basic. Interestingly, there were 14 students who remained at the below basic performance level,

though four of them increased their scaled scores, while the remaining 10 students' scores decreased. One student in the control group moved from basic to below basic.

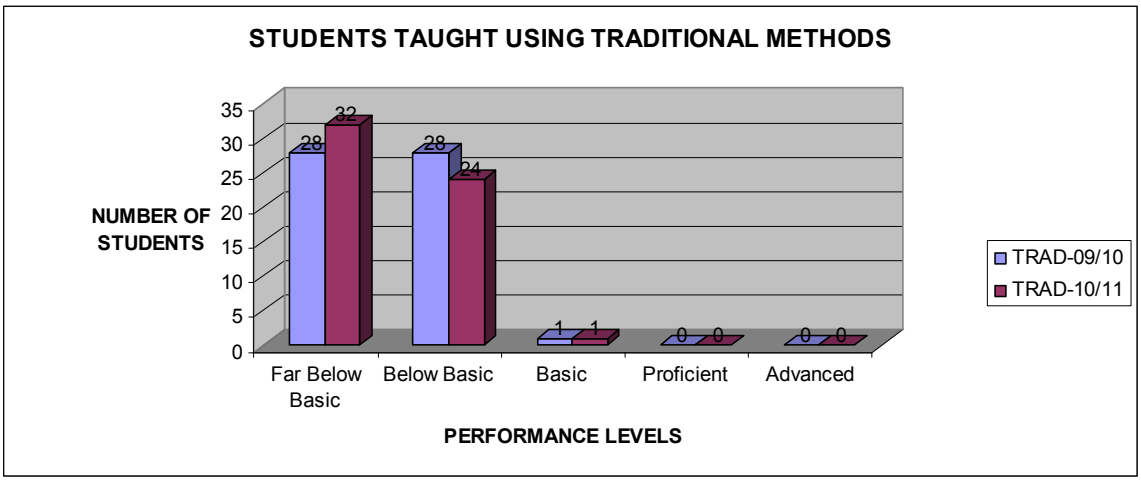

Figure 1. Comparison of Scores from 2009-2010 and 2010-2011 School Years for Students Taught Using Traditional Methods.

Cooperative learning methods. The scores of the students who were taught using cooperative learning methods were somewhat better than those students who were taught using traditional methods. Nine students increased their scaled scores to move from far below basic to below basic. Additionally, of the 15 students who remained at the far below basic level, five had increases in their scaled scores while 10 students had a decrease of their scaled score. The largest gain any student made was from far below basic to basic, which was accomplished by two students. There were 15 students who remained at the below basic level and 11 improving their scaled scores. Four students

who scored below basic had a decrease in their scores, but not enough to be re-classified as far below basic. Four students increased their scores and moved from below basic to basic, while another student was able to move from below basic to proficient.

Special education as a factor. When looking at student performance, the researcher wanted to determine how well those students who were identified as special education performed in comparison to their peers who were not receiving special education services. There were five students identified as special education in the group of students who received cooperative learning instruction. Of these students three had baseline performance levels of far below basic and had negative growth from one year to the next. Two of the students had baseline performance levels of below basic with one remaining at the same performance level, but gaining 10 points on his scaled score. The other student experienced negative growth and moved down into the far below basic performance level.

In the group of students that were taught using traditional instructional methods, seven were identified as special education. Five of those students were far below basic, of which four had positive growth. However, their

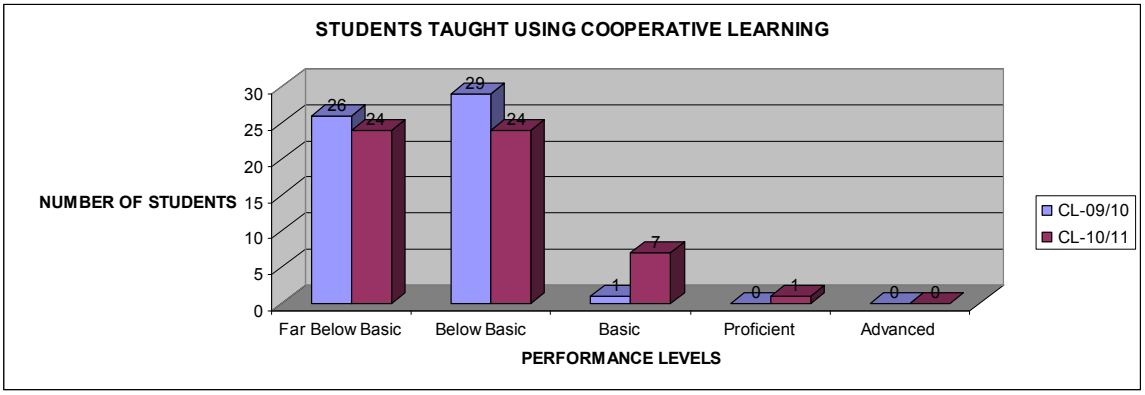

Figure 2. Comparison of Scores from 2009-2010 and 2010-2011.

School Years for Students Taught Using Cooperative Learning scaled scores were not high enough to move them to the next performance level. One student that scored far below basic increased his scaled score by 48 points and moved up to the below basic level. The seventh special education student in this group went from below basic to far below basic and had a negative growth of 51 points. Overall, of the 12 students identified as special education, six of them increased their scaled score. Interestingly, only one of them was taught using cooperative learning methods. There was one gifted student indentified in the entire study. This student was in the class taught using cooperative learning methods. His baseline performance level was basic, in which he remained from 1 year to the next. However, it must be noted that his scaled score increased by 19 points.

Limited English proficiency. When analyzing the scores of students who were labeled as Limited English Proficient (LEP), the researcher noticed that 18 were far below basic, while 11 were below basic. In the entire group of LEP students, 15 achieved positive growth, with six having moved to the next higher performance area from far below basic to below basic. The majority of the students, who achieved positive growth (14), were in the class that was taught using cooperative learning methods.

Summary

The findings of this study are encouraging and suggest that cooperative learning instruction may increase student achievement. The researcher compared the scores of students taught using cooperative learning methods to those students who were taught using traditional methods. Of the students taught using cooperative learning methods, 57% (33) achieved an increase in their scaled score on the Algebra I periodic assessment. Yet, only 40% (23) of the students taught using traditional methods achieved an increase in their scaled score.

Those students who are Limited English Proficient also achieved increases in their scaled scores when they were taught using cooperative learning methods. There were 15 LEP students taught using cooperative learning and 53% (8)

of them demonstrated an increase in their scaled scores, while only 46% (6) of Limited English Proficiency students in the traditional class achieved gains in their scaled scores. In the next chapter, implications for teaching practice and further research will be explored.

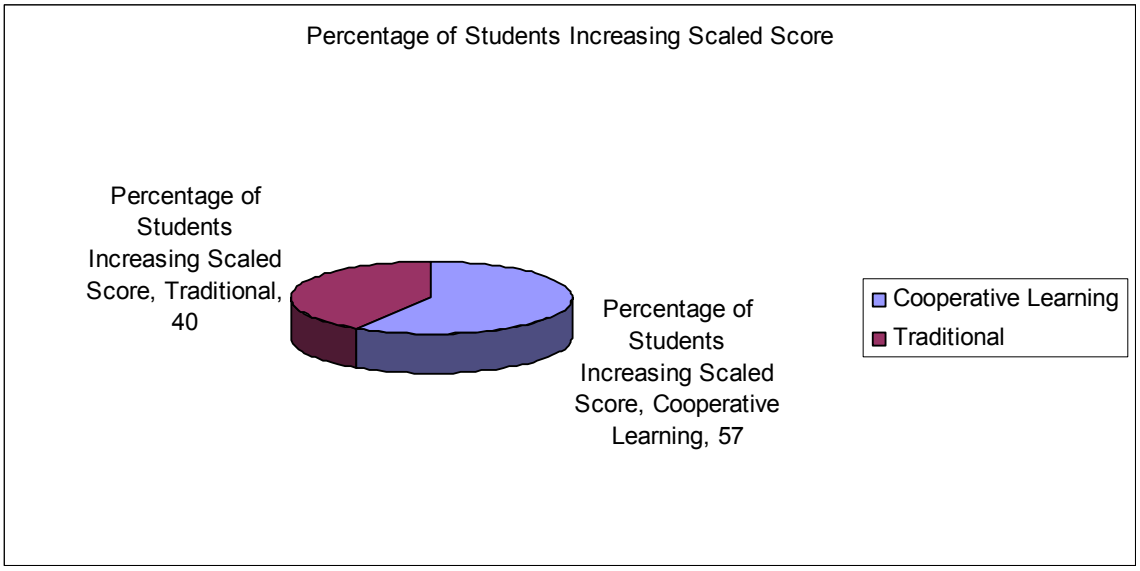

Figure 3. Percentage of Students Increasing Scaled Scores.

Chapter Five

Conclusions and Implications

Introduction

This study was designed to determine whether or not cooperative learning might be a means to increase student achievement in Algebra I. Additionally, this study was designed to address the research question, "How would 56 students in two ninth grade Algebra I classes, taught using cooperative learning method on a comprehensive high school campus in South Los Angeles, score on the Periodic Assessment as compared to 57 of their peers in two separate Algebra I classes at the same school that were not taught using cooperative learning methodologies?"

Findings

The findings of this study suggest that cooperative learning has positive effects on students' academic achievement. Within the experimental group, where cooperative learning was implemented, nine students increased their scaled scores enough to increase their performance level from far below basic to below basic. Additionally, of the 15 students who remained at the far below basic level, five had increases in their scaled scores, while 10 students had a decrease of their scaled score. The largest gain any student made was from far below

basic to basic, which was accomplished by two students. There were 15 students who remained at the below basic level, with 11 students improving their scaled scores.

In the control group, where traditional methods were implemented, the results indicated there were 28 students who scored far below basic. After the study, there were 32 students who scored far below basic. This means there was negative growth in the class that was taught via traditional instructional methods. However, within that group nine students' were able to increase their scaled scores, but it not enough to move them into the next performance level of basic.

The findings of this study are similar to other studies done on cooperative learning. According to Sharan (2010), when cooperative learning is carried out responsibly it can increase students' academic achievement. Additionally, the research of Souvignier and Kronenbeger (2007) indicated a positive correlation between the use of cooperative learning and student achievement. In this quantitative study of ex post facto data, the findings indicated that of the 56 students who were taught using cooperative learning methods, 57% (33) were able to demonstrate an increase of their scaled scores on the periodic assessment. This is in stark contrast to those

students who were taught using traditional methods. There were 57 students who were taught using traditional methods, of which only 40% (23) demonstrated an increase in their scaled score on the periodic assessment. These results suggest that student achievement can be increased with the implementation of cooperative learning methods. The results are consistent with the research of Oortwijn et al. (2008), which indicates when students work together in a cooperative fashion they experience higher rates of learning gains.

Implications for Teaching Practice

This research has several implications for the practice of teaching. As noted in the research of Snowman and Biehler (2003), students learn in a variety of ways and instructional delivery must be varied to reach all students. Traditional lessons tend to be teacher focused with a great deal of lecture and rote rehearsal. As indicated in the research of Ifamuyiwa and Akinsola (2008), the implementation of cooperative learning increased active participation and involvement of students. Therefore, teachers should understand that all students can be reached and can learn the material in an Algebra I class when instructional delivery is tailored to meet the needs of all students. Teachers must implement various instructional

strategies, including cooperative learning. If cooperative learning methods are implemented, students can be active participants in the learning process of Algebra I. This active participation will lower their affective filter and allow them to process and learn the material better, which will then increase their achievement on standardized assessments (Ifamuya & Akinsola, 2008).

The findings from this study suggest that there is a positive relationship between the use of cooperative learning and student achievement. As a result teachers must be creative and flexible with their lesson planning and instruction. Teachers must be willing to think critically about the needs of their students and develop lessons that are creative, fun, and exciting so the students are being challenged to use higher order thinking skills and inference, not just the memorization of key points. This notion was echoed in the research of Sherrod, et al. (2009), which concluded that when students are not active participants in the learning process there is only the transmission of knowledge through didactic lecturing. This is not to say that students should not be responsible for memorizing important terms and concepts; however, there are a variety of ways to present the information to students

rather than solely relying what has become known as *drill and kill*.

The implementation of cooperative learning can be expanded not only to other subjects in mathematics such as geometry and trigonometry but also to other disciplines such as social studies, and ELA. The results of this study indicated that 57% of the students who were taught using cooperative learning methods increased their scaled scores on the Periodic Assessment. With that information not only should school districts begin to provide training for current teachers to be able to implement cooperative learning, but teacher credentialing programs should also add a component to methodology courses that include the use of cooperative learning methods.

This could be especially beneficial for those future teachers who may teach at a school in the inner-city where the study was conducted. As the U.S. Department of Education works on the re-authorization of the No Child Left Behind Act, with research like this to consider it may be prudent to address how instruction is being delivered and not just the qualifications of the person who is doing the teaching. This study indicated that 57% of students who were taught using cooperative learning experienced an increase in their scaled scores on a standardized

assessment. If these methods were implemented nationwide, especially at inner-city schools, as a nation we might finally reach our goal of closing the achievement gap.

Implications for Further Research

This study has only touched the surface of the benefits of cooperative learning instruction. In this particular school, the cooperative learning methods were not implemented until late January and the students were given the assessment at the end of April. As a result, cooperative methods had only been in use for three months before the students had been tested.

One way in which this research could be further explored is by having teachers trained in the summer, which would allow teachers to implement cooperative learning methods for the majority of the school year. Also, in this study the researcher was unaware of which cooperative learning methods were implemented by the teachers. In a future study the researcher could look at the implementation of various cooperative learning strategies to determine if some improve student achievement more than others. The research of Isik and Tarim (2009) concluded that when students are exposed to cooperative learning over an extended period of time there is an increase in academic achievement. That theory lays the foundation of further

research to compare students who are taught using cooperative learning sporadically to those who receive it daily for a semester or more.

Additionally, the study could be expanded to include the eighth grade mathematics classes at the middle school and analyze the data over the course of two years. With this model, the researcher would be able to determine the long term effects of cooperative learning instruction on student achievement in Algebra I. If the results were favorable, it may be enough to encourage school districts to invest in professional development that is specific to cooperative learning. Furthermore, if the cooperative learning instruction allows for significant growth in student achievement in Algebra I it may be appropriate for other subjects at various grade levels.

Also, one may want to conduct a longitudinal study with elementary students starting in kindergarten. The researcher could select two school sites, one experimental the other control, with similar demographics and have all of the teachers at the experimental school trained on the implementation of cooperative learning. Then the researcher can chart the progress of both schools to determine if those students who were taught using cooperative learning

continued to achieve at higher rates than those students taught using traditional methods.

Summary

Though not every student learns at the same pace or in the same way, all students can learn. The implementation of cooperative learning is a way to teach students in a new and different way. Through the use of cooperative learning and understanding of multiple intelligences, teachers can offer a paradigm shift where students take responsibility for their own learning (Janes et al., 2000). The findings of this study suggest there may be a relationship between student scores and the method by which they are taught, which could be examined in a future study.

If implemented with fidelity and consistency, cooperative learning could be used as a way to help eliminate the achievement gap. The curriculum taught would continue to be standards-based; however, teaching would become more student-focused. Using multiple intelligences in conjunction with cooperative learning groups allows students to make choices about their learning. In turn, rather than merely memorizing facts for a test, students are inspired to seek out knowledge for a purpose, which increases retention (Janes et al., 2000).

Furthermore, colleges and universities may want to develop methodology courses that implicitly teach future educators not only how to implement cooperative learning but also its benefits as well. With the information gathered from this study other researchers will be able to expand on the topic of cooperative learning in subjects such as science, social studies, and ELA to determine if there are similar increases in student achievement.

Cooperative learning may be what is needed in the United States to ensure that all students are achieving academically. Further research must be done on this subject to determine if it is a method that should be adopted at all levels nationwide. The only way for that to occur is if further research is done to determine its efficacy. The positive results of this study warrant further investigation and anyone interested in increasing student achievement may want to explore cooperative learning as a means to reach that goal.

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