Co-Teaching vs. Solo-Teaching:

Effect on Fourth Graders' Math Achievement

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Abstract:

As education continues to progress schools are constantly seeking innovative ways to cultivate and enhance achievement for all students. As a result many public schools are pushing toward the inclusion model. This model includes co-taught instruction to meet the many needs of special education students. This research study was implemented to investigate the comparative effects of co-teaching versus solo-teaching on student's math achievement in elementary school. Study participants included two fourth grade classes in an elementary school, one with a regular education (solo-teaching) and the other with the same regular education teacher and a special education teacher for the co-taught class. The independent variable is the teaching arrangement (co taught class vs. a solo-taught class) as considered by the school system and the dependent variable is the math achievement as measured by Number Sense, Multiplication, and Division pre and post test units. Comparison of student math achievement between co-teaching and solo-teaching showed that solo teaching was more effective than co-teaching on student's achievement in Multiplication, co-teaching was more effective on student achievement in the Number sense unit than solo-teaching, and that no statistical difference was shown between co-teaching and solo teaching in their effect on student learning in the Division unit. It is concluded that both solo teaching and co-teaching were beneficial to the two different groups of students within their various learning environments. Further experimental research is needed.

Introduction

Americans have made a historic commitment to educational excellence. Education continues to be a global issue that warrants research, resources, and reforms. With academic achievement and educating the whole child sitting at the forefront of today's educational system, we are making strides to revolutionize the traditional classroom model that once separated students with disabilities from their same age peers through the development of inclusion classes and standards based curriculums. Over a decade ago, President George Bush took the impetus to change the way that America looked at education when he announced No Child Left Behind (NCLB). It was not that President Bush did not believe in our school systems, but he stated that "too many of our neediest children are being left behind" (ED.Gov, 2005, Para. #1).

According to Ed.Gov, the NCLB was further established to close the achievement gap that exists among students within our nation's school. The achievement gap in education refers to the differences that are seen between groups of students (Ed.Week, 2011, Para. #1). Concerns around this issue are also seen in the areas of testing, course selection, grades, and other measures of success. Significant disparities were seen in Black, Hispanics, and other low income students in comparison to their white and more affluent peers in math and reading (Ed.Week, 2011, Para. #1). These scores were so troubling that they were much of the momentum for the accountability measures of the NCLB which included the requirement of schools to separate the performance data by student characteristics to better compare groups.

With this is mind the NCLB began to focus on closing the achievement gap in those areas through providing targeted interventions for these groups of students. Many people say that the NCLB is not closing the achievement gap, but statistics say differently. Since the nationwide

challenge of the NCLB, the National Assessment of Educational Progress (NAEP) finds that more reading progress has been made by 9- year -olds between the years of 1999-2004 than in the previous 28 years combined (Ed.gov, 2007, P.2). To further support these findings, in 2007, U.S. Secretary, Margaret Spelling, reported that "Math scores for 4th- and 8th-graders and the reading scores for 4th-graders are at historic highs and the biggest gains were made by African American and Hispanic students" (Ed.gov, 2007, Para # 4).

In contrast to these statistics, The National Center for Education Statistics in 2009 and 2011 showed that Black and Hispanic students scored as much as 20 test score points lower on the NAEP reading and Math assessments at 4^{th} and 8^{th} grade levels. This data revealed a difference of about two grade levels. (Ed.Week, 2007, Para. #3). To an even greater amazement, this gap persists even though it narrowed between 1992 and 2007 in 4th grade Math and Reading, as well as, 8^{th} grade Math. Today, these scores still raise great concern due to the huge breach between these subgroups. Strides have been made within them, but not enough to appreciate since the inception of the NCLB. Although these results are positive, some people still question the validity of the NCLB.

The achievement gap also raised concerns in the areas of students with disabilities. As a result, the idea of a quality education stemmed to these students. The NCLB along with the 1997 Reauthorization of the Individuals with Disabilities Education Act Amendments (IDEA) explicated the regulations for creating Least Restrictive Environment by clarifying that regardless of disability; all children must receive full consideration for placement in the regular classroom. An amendment was made to the 1997 Act and it is know n as the IDEA 2004. IDEA 2004 mandated the inclusion of students with disabilities and required that they have access to the general education curriculum while meeting the individual developmental needs of special

education children through annual measurable objectives. As a result of these landmark laws, parents, educators, and researchers are seeing a growing number of students with disabilities return to general education classrooms.

Advocates of students with disabilities have urged the inclusion of students with disabilities in the general education curriculum; hence much of the momentum for co-teaching or team teaching, a method of support inclusion. The implementation of co-teaching can be traced directly to the NCLB and the requirements for student performance on mandatory state tests (Cramer &Nevin, 2006).

As schools have begun to implement these laws, student who have been identified with a learning disability are provided with an Individual Education Plan or IEP to meet their specialized educational needs, as well as the unavoidable education laws. Many schools have chosen to use the inclusion model of pairing both a highly qualified regular education and special education teacher together to plan, deliver content, and evaluate progress for a diverse group of students in a single classroom (Cook & Friend, 1995). An effective co-teaching model is said "to likely increase the outcome for all students in the general education setting, while ensuring that students with disabilities….are provided instruction by a content expert" (Murawski &Dieker, 2004, p.52)

Statement of the Research Problem

A plethora of research has been done on the effects of co-teaching, but it shows inconclusive results (Murawski &Swanson, 2001.) In order to best serve students with disabilities in their least restrictive environment, co-teaching was implemented into the school system. This study was designed to investigate the comparative effects of co-teaching versus

solo-teaching on students' math achievement in two fourth grade classrooms. Specifically, this study intended to address the following research questions: Do co-teaching and solo-teaching have different or same effects on 4th graders' math achievement? If there are different effects, which method, co-teaching or solo-teaching, has more positive effect?

For this action research project in which the researcher was also the classroom teacher, two intact fourth grade classes at the same elementary school were involved for comparison. The solo-taught class consisted of 28 students including 8 who are gifted and 1 student with an IEP. The co-taught classroom consisted of 24 students with both general education and special education students combined, including 7 students with IEP's, 2 of them are pulled into resource classes for content areas (only one of them for math; therefore this student's grades will not be included in the data), and 1 of them receives speech service and occupational health services for his handwriting.

According to the school system's student classroom selection, these two groups were comparable. The process that the school system used to determine how classes are grouped is as follow: First, the school administration looks at the state requirements for gifted students. With our school demographics we have to have 8 gifted classrooms in accordance to the state regulations. Second, the Special Education Students are looked at to determine how they will be served in their least restrictive environment to fit their specialized needs. Next, the decision is made to determine who will teach the inclusion classes. Once these things have been taken into consideration and set in place, then the remainder of the student body is compiled unto a spreadsheet and disseminated into classrooms based on specific subgroups. With the exception of the gifted and special education students, the makeup of the classes is comparable based on

their previous test scores. For this study, data from these students' pre and post test were analyzed to determine the comparative effects of co-teaching vs. solo-teaching.

Definition of Terms in this Study

Co-teaching: a service delivery model using two teachers, a general education teacher and a special education teacher, to plan, deliver content, and evaluate progress for a diverse group of learners in a single classroom. (Cook &Friend, 1995)

Solo-Teaching: one qualified teacher plans, teaches, and improve student education and learning.

Math Achievement: the level of attainment in any or all math skills, usually estimated by performance on a test. (www.education.com, 2011, p.1) The math performance is measured by teacher made unit test from the school adopted math curriculum. (*Houghton Mifflin Math, 2007*)

General Education: a regular classroom setting with standards based curriculum

Inclusion: a classroom setting that has the same age peers with differing abilities ranging from gifted to those with special needs.

Review of Literature

Today as more students with disabilities are entering into the general education classroom, educators and researchers are continuously seeking for ways to enhance overall student achievement despite the challenges that they face with these at risk students. According to the new mandates of the NCLB, even though these students are considered to be at risk learners they still have the same achievement targets (Ed.Gov, 2007, P. 5). In hopes of meeting

the challenges that they face, classroom teachers have adopted inclusive models of instruction with emphasis on collaborative structures such as co-teaching (Tobin, 2005).

This approach involves both a general education and special education teacher who possess distinct skills to teach academically and behaviorally heterogeneous group of students. (Bauwens & Hourcade, 1995). Both of these teachers will provide instruction, discipline, and support for all students. This approach takes away the humiliation or rejection that special education students may face by meeting their needs inside of the general education classroom.

Co-teaching is a very popular model that is being implemented in classrooms all across the United States in order to meet the individual needs of all students. Co-teaching is a method that involves both a general education and regular education teacher planning, delivering the instruction, and evaluating student progress (Cook & Friend, 1995). According to Basso & McCoy (2007), the knowledge of co-teaching is said to bring together the knowledge and skills of two highly qualified teachers and reiterates that the benefits are innumerable.

There are several co-teaching models. These models can take place in a number of forms and settings. No one particular model is meant to be used exclusively (Cook & Friend, 1995). Cook and Friend (2004) describe six models of co-teaching. They are: one teach/ one observe, one teach/one drift, parallel teaching, station teaching, alternative teaching, and team teaching. Each of these models has both strengths and things to be cautionary about. Both the general education and special education teacher must work together in order to recognize their particular strengths, comfort level, and competence in order to meet the needs of all students.

One teaching, One Observe

One of the advantages of co-teaching is that teachers are not only able to provide students with their distinct skills in order to meet their individual needs, but they are also better able to make true observations of student engagement during the learning process. In this model, one teacher takes the lead role while the other engages in detailed observations or data collection. This approach requires teachers to plan in advance what type of data need to be collected, how to gather the data, and how the both of them will sit down a further analyze it (Cook & Friend, 1995).

One Teach, One Drift (One Teach/One Assist)

There is a wealth of information on the different models of co-teaching. It is interesting to note that, the model that was once called one teach/one assist is now called one teach/one drift (Cook, 2004) . Although the name changed for the model, there does not seem to be any other noted differences. This model is much like the one teach/one observe, but it involves the other teacher more. As one teacher takes the lead, the other moves throughout the room to assist with one on one instruction, check for understanding, and monitor goals (Cook &Friend, 2004). The caution of this model is that it does not require much planning and that it could force one teacher into the role of an aid (Friend & Cook, 2004). Both teachers should alternate between the roles to maintain parity.

Within the inclusion classroom it is very beneficial for both teachers to take on an active role and alternate between the lead/assist roles whenever possible. Students must see the teachers collaborating and sharing the teaching responsibility and discipline for all children. I have been in a number of classrooms where the general education teacher only wants to teach/discipline the

general education students and leave the special education teacher to assist the students with special needs. The NCLB was established to ensure that all students are able to receive a quality education in the same setting as their same age peers. As educators, I feel that we should be the first to personally implement this law. As a child advocate, I will continue to fight that the needs of all children be met inside of the general education classroom in order to avoid stigmatizing them.

Parallel Teaching

In parallel teaching the class is divided into 2 equal groups with the teachers both teaching the same information but in different ways, but the class is halved. (Cook and Friend, 1995). This lowers the student teacher ratio and allows for more hands on learning, peer interaction, and verbal responses. These students may be randomly grouped or based on their skill levels, behavior, learning styles, assessment results and multiple intelligences (Karten, 2005) Both teachers must plan and know the content in order to make sure that both groups of students receive quality instruction at the same time. The cautions of parallel teaching are ensuring that both teachers have content mastery, pace themselves, and the noise level among the group (Cook & Friend, 1995).

Station Teaching

Station teaching allows teachers to divide the content into three or more groups throughout the room and rotate from one to the other. (Cook &Friend, 1995). In this model, the teachers may divide the content into two stations and teach half of the students and then trade off. Usually, a third station is added for the students to do independent work or work with a partner. These students may be grouped randomly or according to their abilities, behaviors, or

learning styles. With this model, both teachers share planning and content delivery. Station teaching lowers student teacher ratio and it integrates students with disabilities. It is appropriate for all grade levels and it equals the teacher status within the classroom because both teachers are taking on an active role. The cautions of station teaching are pacing, noise, reduction of group size, can take a number of days for completion, and greater differentiation.

Alternative Teaching

In this model the class is divided into a large group and a small group of students. (Cook &Friend, 1995). This method may be highly effective for students with disabilities because it includes remediation, review, skills assessments, extra practice, pre and re teaching, reduction of group size, and extended activities. The primary caution of this group is that it does risk stigmatizing students, but this can be reduced by varying the group (1995).

Team Teaching

Team Teaching allows both teachers to share in planning and instruction (Cook & Friend, 1995). In team teaching, both teachers are delivering the same instruction at the same time. Oftentimes, this model is referred to as having "one brain two bodies" while others call it "tag team teaching" (Cook & Friend, 2004). Many teachers consider this to be the most satisfying way to co-teach. This approach requires mutual commitment, trust, and collaboration (1995).

Research regarding co-teaching

The idea of including children with disabilities in our general education classroom through the inclusion model is still not an ideal concept even though it has gained popularity in our school systems across the nation. This is largely due to inconclusive research evidence on

the validity of co-teaching regarding students outcomes whether with or without an identified disability (Weiss & Brigham, 2000; Murawski & Swanson, 2001), which leaves room for further research.

In the reviewed literature on co-teaching, much of the research was combined with comparative results of other things like students' attitude, different learning models, and teacher perceptions and collaboration. A study was done in the Appalachian Mountains to examine peer coaching through a Mentored Implementation Program (MIP) (Murray, 2009). The purpose of the study was to examine the effectiveness of a job-embedded professional development model of peer coaching and to determine if peer teaching could improve math achievement scores. The research setting consisted of a number of major universities including Kentucky and Tennessee, as well as, Virginia school districts, regional universities, colleges, and agencies to develop an overlapping network of partnership and mentoring.

Teachers for the study had to attend the summer MIP, participate in MIP activities, and work with another teacher throughout the year. The participants were 14 teachers in 6 schools, from four districts. The experimental group had 9 teachers with 202 students and the control group had 5 teachers with 105 students. The students were comparable across the board. A qualitative method was used to determine the collaborative effects and perceptions among mathematics teachers. A quantitative method was used to analyze pre and post test scores of students in both the experimental and control group and to explore the relationships between peer coaching and student math achievement.

The measurements that were qualitatively used were short surveys that included open ended questions, observations, and collaborative interactions. Quantitative measurements consisted of the development of a skill-based test that is independent of any curriculum.

The findings of the research study showed that teacher's perceived peer coaching to be positive because they were able to share ideas and provide feedback about their teaching practices. The finding in relation to student achievement showed no improvement in mathematics due to teachers having attended the MIP (Murray, 2009).

The Welsh inclusion model is a popular inclusion model that was introduced in 2006 during a time when Students with Disabilities (SWD) had a composite score of 20.8% of state test. This meant that only 1 in 5 Students with Disabilities passed the reading and math portions of the test (Pickard, 2009). Research shows that this model has yielded positive effects when incorporated in the general education classroom, as students with special needs showed academic improvement on state-wide tests (Pickard, 2009). Even though huge gains are needed to meet the 2013 federal mandate for all students, a gain of 12.5% is shown in the SWD group population.

The Welsh inclusion model was incorporated into an elementary school in North Carolina that was severely struggling with state testing. Their 2008 report card showed that students with disabilities had shown little progress in both math and reading (Pickard, 2009). The study was done to identify the academic culture of the classroom as well as the functionality of the inclusion teams.

Uniquely this program consisted of four different phases of implementation: The first stage consisted of team –teaching trainings, phase 2 consisted of lesson implementation in the

classroom. During this stage the students were broken into pods which were groups of 3-4 students utilizing their individual learning modalities (Pickard, 2009). In stage 3, the teachers developed the foundation for the Model within their school district. Phase 4 was the follow up stage for evaluations. The study findings showed that students had academic success regardless of the level of difficulty while they were within the pods, a change in student attitude about special needs children, and that teachers were able to freely experiment with instructional strategies that enhanced students success. (Pickard, 2009).

A qualitative study was done at a Middle School in British Colombia to examine teacher's use of co-teaching models to support students with learning disabilities in an inclusive classroom. The initiative was part of a larger school district movement toward inclusive practices for students with disabilities. The classroom was a 6^{th} grade Language Arts room with 29 students; five had IEP's, three with Learning disabilities, one student with a hearing impairment, and one gifted. Among the remaining students five were reluctant reader and writers.

The following questions framed the research: In what ways did we, as co-teachers, support students with disabilities in an inclusive grade-6 language arts classroom? How three students identified with LD access help in an inclusive setting?

In this case study the researcher played dual roles whereas she was the resource teacher and the researcher. The method that she used for the research took a real-life approach whereas "how" and "why" questions were the focus. The researcher collected data from multiple sources: tape recordings of participant observations, field notes on planning meetings, tape semi-structured individual interviews with students, interviews with classroom teachers, and interviews with teacher assistants. Also, the researcher served as a co-teacher with the regular

education teacher three times per week for 50-minute blocks. Non-verbal notes were taken on behavior and contextual information during these settings.

The resource teacher had been teaching for 10 years in special education and 8 years in regular education. The regular education teacher had been teaching for 8 years. The students were chosen based on designation under British Colombia Ministry of Education guidelines as students with severe LD and impending transition to Middle School. The teacher was chosen based on her motivation to be a part of the study and her interest in both co-teaching and professional development related to exceptional students.

The finding to the research questions were as follows: The ways in which students were supported in the classroom, emerged in three themes: learning support within the co-teaching structures, explicit teacher-investigated literacy support, and interactional inclusion. The second question was how do the students with LD access the curriculum? They were able to get help by asking teachers, using the HELP Board-a board where you write down what you need help with, and by asking a nearby friend (Tobin, 2005).

The University of Cincinnati was provided a grant that allowed them to partner with a school to create and implement professional development trainings. The conductor of the research was a student at the University of Cincinnati in pursuit of his doctoral degree. The setting of the research was in 3 co-taught classrooms in a small middle school. Each one of these classes had a student teacher from the University of Cincinnati and at least 2 students to receive special education services. In two of the classes there were as many as three students classified as English language learners.

The focus of the research was to investigate student engagement when co-teachers used multiple strategies for co-teaching, particularly one teach/one assist, station teaching, alternative teaching, and team teaching. The research question was: Given that multiple co-teaching strategies exist, how, if at all, do particular strategies for co-teaching affect the engagement of students with and without disabilities.

The participants were recruited for the study. The teachers were chosen based on request for additional support and individual coaching, attending three days of training, voluntarily participation, teaching at least one co-taught bell per day, and demonstrating administrative support to allow for co-teaching on a daily basis. Five teachers were chosen for the study. They were all white females with 3-31 years of teaching experience. Six students were chosen. Five of them were white and one black. Four of the students were female and two of them were male students. They were all in one of the co-taught classrooms, 3 of them had an IEP plan, two of the students were identified to have a learning disability and one of them was identified as having a cognitive disability. They used a number of instruments to conduct this study: observations, reflections, interviews, collaboration assessment logs, visual analysis.

The result of the study showed that students with and without disabilities followed similar trends in their changes of engagement in co-taught classes. Regardless of the co-teaching strategy that was used they showed upward trends in levels of engagement. More significant changes were made in engagement when methods were used other than one teach/one assist (Embury, 2011).

A small study was done in eight science classrooms in the suburbs of a large metropolitan area over an eight week period in the eastern United States to determine the differential effects of

peer tutoring in co-taught and non- co taught classes. This study was done based upon alarming science statistics that students with disabilities tend to fall behind in middle and high school science classes (Anderman, 1998; Mastropierie, 2006). To access the impact of peer tutoring four different conditions were examined a). Co-taught with peer tutoring b). Co-taught without peer tutoring c.) Non co-taught with peer tutoring, and d). Non co-taught without peer tutoring.

The instruction in both the non co taught and the co taught classes were the same with the exception of the peer taught classes. In the peer taught classes, the students were paired by their teachers according to their academic achievement. Then, they were trained to be both the tutor and the tutee during the first sessions of the class. The first 10 minutes of the peer taught classes were taught by peers instead of the traditional method of instruction. The students were given a folder that had all of their daily materials readily accessible. During each session, each student had to play the role of tutor and tutee. Tracking sheets were kept to ensure that the students were engaged in the activities that were planned; however, the teachers did not evaluate the student responses at this time.

The results of this study showed that students who were in the peer taught settings performed better than students who received traditional instruction on unit test although no differences were shown on cumulative tests, students in co-taught setting out performed students in non co-taught settings on unit tests and the overall cumulative tests, and there was no interaction between co-teaching and peer tutoring, suggesting that there was no value added when peer-tutoring was implemented in a co-taught environment.

This study shows that there is no direct link between peer tutoring and co-teaching with the exception of engaged time on the task. Research suggests that co-teaching increases time task engagement, but does not automatically lead to increased academic achievement (Dieker, 2001;

Mastropieri, Scruggs, & Graetz, 2005; Walther-Thomas, 1997). This adds to the other inconclusive research about co-teaching and adds to the mixed emotions that people have concerning the effectiveness of it.

The term co-teaching produces mixed emotions when discussed with teachers, parents, and students (Bennett, Deluca, &Bruns, 1997; Garrick Duhaney & Salend, 2000; Sodak & Erwin, 2000). Research shows that collaboration between the students, educators and family members are essential in the implementation of a successful inclusion program (Gallagher, 2000). Parents of students with disabilities desire for them to be included into the general education classroom in order to have the same experiences of their same age peers, whereas the parents of students without disabilities dispute having their general education classroom placed in an inclusion setting.

For the past two years, the primary author has served as a special education teacher in a resource setting and this year in an inclusion setting. Most parents that I have encountered of students without disabilities do not want their child in this type of setting due to the negative connotations, false information, and lack of knowledge concerning the model. A lot of students with disabilities have behavioral related issues and parents feel that these behaviors always impede the learning of the students when this is not always the case. The inclusion model has created a road for students with disabilities to travel, but we still have a lot of reconstruction to do. The students are benefitting from being in the general education classroom with their same age peers, and the primary reason for success is through their Individualized Education Plans which includes the needed modifications and accommodation.

When President Bush decided to implement NCLB these students were no longer left behind, but afforded every opportunity for a quality education just like all other students and to

hold schools accountable in state wide testing. Student results on the 2010 Criterion-Referenced Competency Tests (CRCT) in Georgia were up in almost every grade and content area (public.doe.k12.ga.us, 2010, Para 1) In relation to last year's test scores improvement was shown in 25of 34 content areas (public.doe.ga.us, 2010, Para 2). Results also show that the achievement gap between the more affluent white students and other minority groups continues to narrow (public.doe.ga.us, 2010, Para 5). State testing scores vary from state to state and the results depend upon expectations, quality, and implementation of instructional strategies to meet the needs of all students. As education continues to change and shape over time, we must continue to move forward and keep the students at the forefront of our decision making.

Method

Overview of the Project

This study was conducted to determine if co-teaching and solo teaching have different effects on student learning in math by comparing the learning outcomes of students in a co-taught classroom with those students in a solo-taught classroom at an elementary school. In regards to one class being co-taught and one being solo taught, the students were taught lessons from the same lesson plan and were administered the same test. The students, with disabilities in accordance with their IEP's, received the necessary accommodations in compliance with the federal law. The solo taught class consisted of 28 students and the co-taught classroom consisted of 24 students. The general education math teacher is the same teacher for both the co-taught class and the solo taught class. The co-taught classroom has a special education teacher included.

In this inclusion classroom the alternative teaching model was used on a consistent basis. It provided the students with disabilities, as well as all students, a number of opportunities and

different ways to gain content knowledge. The students love the different settings and the two different teaching styles that are offered as a result.

Research Questions:

Do co-teaching and solo-teaching have same or different effects on fourth grade student math achievement? If there are different effects, which method, co-teaching or solo-teaching, has more positive effect?

Hypotheses

Co-teaching and solo-teaching will have different effects on student math achievement in elementary school, with co-teaching having more positive effect than solo-teaching on fourth graders' math achievement.

Description of the Sample

The study was conducted at an upper elementary city school consisting of 766 fourth and fifth grade students. The school has made Adequate Yearly progress since its establishment in 2005.The school has a very diverse population with 299 Caucasian students, 219 African Americans, 92 Hispanics, and 39 multiracial students. On a smaller subset 57% of the students are considered economically disadvantaged, 22 students with Limited English Proficiency, and 52 students with disabilities.

The students of this study were two fourth grade classes. These two classes were selected due to their similarity in student abilities according to the school systems selection process. The general education teacher was approached because she shared the role of both solo-teaching and co-teaching. When approached with the idea of being a part of a study, she showed a willingness

to participate and assist as she could. In the beginning, she did not feel that the classes were comparable based on one class having 8 gifted students and the other class having none. The students that I am referring to as gifted are identified as such through the school system and they are a part of the gifted program. After finding out how the students were chosen for each classroom, she agreed that the solo taught class and the co-taught classes are comparable with the exception of the gifted students. She stated that with the exception of the gifted students that they are all "just average students". I did choose to include all of the students in this study because I wanted to see the effects of co-teaching versus solo-teaching on student achievement with in the

The co-taught class consisted of 24 students and two teachers (general education and special education teacher). The classroom had 7 students with IEP's. One of these students receive resource math; therefore, this students scores were not included in the data. 11 of the students were girls and 13 of them were boys. Two of these students moved in as the data was being collected. The solo-taught class consisted of 28 students (11 boys and 17 girls). Eight of these students were gifted and only one of them had an IEP. The regular education teacher taught both the solo and co-taught classes. She is a veteran with twenty-seven years of experience as a math teacher and holds a Master's degree. She has nine years as a fourth grade teacher and eleven years of co-teaching. The co-teacher is in her second year of teaching and is in a Master's Degree Program.

Table1 below shows the composition of the two classes.

Table 1. Demographics of Solo-Taught and Co-Taught Classes

	Solo-Taught Class	*Co-Taught Class*
Gender		
Male	11	13
Female	17	11
Ethnicity		
White	15	14
Black	8	6
Hispanic	4	4
Other	1	0
Abilities		
Gifted	8	0
IEP	1	7
Regular	19	17
Achievement		
Average Math	15	13
Average Reading	18	15

Data Collection and Analysis

Data was collected from both classes through pre and post test of two different learning environments. All of the Math units were introduced with a pre-test, teaching of standards, unit vocabulary, standards based instruction, and ended with a post-test. Student scores were collected for three pre and post test in the areas of number sense, multiplication station, and division. These scores were compared to determine if there is any growth in the students achievement and to show if co-teaching yields more positive results than solo teaching.

The unit tests were created by the school adopted math curriculum, *Houghton Mifflin Math Georgia* (2007). The unit tests were created to look for strengths, weaknesses, and to help

establish groups for classroom instruction to further determine which students needed remediation or enrichment in alignment with the Georgia Performance Standards. On average, each test consisted of 25-35 test questions, with 100 being a perfect score and 0 being the lowest score. The timeline of the pretest, unit teaching, and posttest for each unit was dependent upon the unit, and the needs of the students. Some of the units took longer to teach than others, but the normal time frame was within 4-5 weeks. The units were taught in this sequential order: Number Sense, Multiplication Station, and lastly Division. These were the first three units that were taught beginning in August and extending into mid October. The tests were administered by each classroom teacher, and they were scored using the Acel scan technology that is used within our school system.

A series of paired t test were conducted to compare the effects of co-teaching vs. solo teaching on student math achievement as measured by unit test grades for both pre and post test for both the Solo-Taught and Co-Taught classes. Data collected on the students are presented in the tables below.

Table 2: Summary of t-tests Comparing Pretest and Posttest Scores within Solo- Taught Group

	Mean	*SD*	*N*	*t*	*df*	*P Value*
Multiplication-Practical Difference 89.9-79.9=10						
Pre	79.9	19.75	19	3.5807*	18	0.0021
Post	89.9	13.97	19			
Number Sense-Practical Differences 86.26-76.74=9.52						
Pre	76.74	8.19	19	4.8042*	18	0.0001
Post	86.26	9.83	19			
Division-Practical Difference 89.842-61.142=28.706						
Pre	61.142	24.135	19	7.0334*	18	0.0001
Post	89.842	16.372	19			

significant, P<.05

Table 2 consists of Unit Pre and Post test for each unit within the solo taught classroom. A paired t test was performed for each of the units to determine if there was a significant difference in the pre and post test scores in the solo taught class. The t test results show that there is statistical difference between pretest and post test scores in each of the subunits. The practical difference between pre and post test in each subgroups is also considerable, which seems to indicate that students in the solo taught classroom did improve significantly in each unit.

Table 3: Summary of t-tests Comparing Pre and Post Test Scores within Co- Taught Group

	Mean	***SD***	***N***	***t***	***df***	***P***
Multiplication-Practical Difference 81.19-70.88=10.31						
Pre	70.88	15.03	16	2.8522*	15	0.0121
Post	81.19	8.31	16			
Number Sense Practical Difference 84.81-60.31=24.5						
Pre	60.31	8.18	16	8.8101*	15	0.0001
Post	84.81	5.71	16			
Division Practical Difference 69.169-41.456= 27.713						
Pre	41.456	15.684	16	6.0537*	15	0.0001
Post	69.169	25.042	16			

****Significant, P<.05***

Table 3 consists of Unit Pre and Post test for each unit within the co-taught classroom. A paired t test was performed for each of the units to determine if there was a statistical difference between pretest and posttest scores in any of the subunits. The t tests show that there is significant statistical difference between pre and post test scores in each of the units. The practical difference between the pre and posttest is also considerable, which indicates that co teaching worked for these students.

Table 4: Summary of Solo-Taught and Co-Taught Pre-Test Comparison

	M	*SD*	*N*	*t value*	*df*	*p value*
Multiplication						
Solo-Taught	79.79	19.75	19	1.4794	33	0.1485
Co-Taught	70.88	15.03	16			
Number Sense						
Solo-Taught	76.74	8.19	19	5.0984*	33	0.0001
Co-taught	61.19	9.86	16			
Division						
Solo-Taught	62.195	23.436	19	3.0133*	33	0.0049
Co-Taught	41.456	15.684	16			

Significant, P<.05

Table 3 consists of Unit Pretest for each unit within both the solo and co taught classrooms. An unpaired t test was performed for each of the units to determine if a statistical difference was shown. In regard to the Number Sense and Division units there were statistical differences within these units during the pretest, but no statistical differences were seen in the Multiplication pretest. The difference shows that the two classes were not comparable from the beginning in the Number Sense and Division subunits, with the Solo-taught group being higher on average; but the two groups were comparable in Multiplication unit. My personal opinion as to why these two groups were comparable in the Multiplication unit and not in the other two are that most students know how to multiply which predominantly requires recall and basic algorithms whereas division and number sense involve more problem solving and mathematical reasoning.

Table 5: Summary of Solo-Taught and Co-Taught Post Comparison

	M	*SD*	*N*	*t value*	*df*	*p value*
Multiplication						
Solo-Taught	89.89	13.97	19	2.1858*	33	0.036
Co-Taught	81.19	8.31	16			
Number Sense						
Solo-Taught	86.26	9.83	19	0.5205	33	0.6062
Co-Taught	84.81	5.71	16			
Division						
Solo-Taught	89.826	16.361	19	2.9323P*	33	0.0061
Co-Taught	69.169	25.042	16			

**Significant, P<.05*

Table 4 consists of Unit Post Test for each unit within both the solo and co taught classrooms. An unpaired t test was performed for each of the units to determine if a statistical difference was shown. Results show that there were significant differences between the two groups in posttest scores of Multiplication and Division units, but no significant difference in Number Sense. Since the two groups were comparable in Multiplication pretest scores (see Table 4) but significantly different in posttest scores, with the solo-taught group being higher on average (89.89>81.19), it indicates that solo-teaching had more effective effect than co-teaching on students' achievement in Multiplication.

There was significant difference between the two groups in Number Sense pretest scores (see Table 4) with Co-Taught group being lower (61.69<76.74), but no significant difference in posttest scores, it shows the Co-Taught Group improved significantly more than the Solo-Taught group and the gap was closed, which means co-teaching was more effective than solo-teaching in improving students learning of Number Sense. Further, since the two groups were not comparable in Division pretest scores (see Table 4) and remained significantly different in

posttest scores, it indicates that there is no significant difference between co-teaching and solo-teaching in their effect on student learning of Division.

Results and Conclusions

This research project was done to determine if solo teaching and co-teaching have the same or different effects on fourth grade math achievement and to further determine if there are different effects, which method, co-teaching or solo-teaching, has more positive effect? The focus of the research was to designed to clarify if students that were served in the co-taught classroom would show more growth in their math achievement than the students in the solo taught classroom. Co-taught classes are on the rise across the Nation and they are beneficial to all students, but especially to students with disabilities. The different teaching methods that can occur in a co-taught classroom allow pre and re teaching of concepts, smaller grouping, extended activities, remediation, extra practice, flexible grouping, and different skill levels, behaviors, and learning styles to be grouped together.

The students in both the co-taught and solo taught classroom were assessed through pre and post test to see if they were indeed comparable groups in math performance. The assessment period consisted of 3 pre and 3 post test including Number Sense, Multiplication, and Division units. The general education teacher taught in both of the classes, and the special education teacher only taught in the co-taught classroom. Common planning was not shared; therefore, some difficulties occurred in planning due to conflicting schedules and teacher absences.

The model that was used on a consistent basis was the alternative model. This model worked well with the group of students in the co-taught classroom because of the small group size, extended activities, pre and re teaching, remediation, and extra assistance that it provided.

When we used this model the teacher would break the group in half and the special education teacher would take half of the group into the hall for 20-30 minutes. The general education teacher would have the other group in the classroom usually introducing a new lesson or extending on the previous one. We would use two 20-30 rotations to ensure that all students were provided with equal opportunities to ask questions, check homework, and receive needed assistance.

The only other model that we consistently used was the one teach/one assist model. We started out using this model 4/5 days, but it seemed to take more time to do it this way, so that is when we decided to lean more to the alternative model. As a result, our students had the highest gains on these three units in comparison to the whole school's math scores. We experienced success in a number of ways. Teacher parity was formed, students were comfortable in asking and answering questions, and instruction was continual in both of the groups.

The class selection for this research project was based on the general education teacher's willingness to cooperate, her years of teaching experience, and the teacher parity between the classroom teacher and general education teacher. Once I began to look into the previous CRCT scores and the identification of the gifted and special education students who were within the two classrooms, I did not feel that the two classes were comparable at all. The solo taught classroom consisted of 1 student with an IEP and 8 gifted; whereas, the co-taught classroom had 0 gifted and 7 students with IEP's. Immediately, I went to talk with an administrator concerning this matter. She clearly affirmed that the two classes were comparable based upon the school's selection process; therefore, I proceeded to carry out the action research project.

A series of paired and unpaired t tests were done to either support or negate the hypotheses for the Number Sense, Multiplication, and Division units. In regards, to comparing the data within the solo-taught classroom t test was performed to see is the students improved from their pre test to their post test. The results indicate that students in the solo taught classroom did improve significantly in each unit. The same was applied with the co-taught classroom. The results of the t test indicated that co teaching worked for this group of students.

A series of unpaired t test were performed to determine if a statistical difference was shown for the three units for the pre test assessments in Number Sense, Multiplication, and Division. As the raw data was dissected it indicated that the two groups were not comparable from the beginning in Number Sense and Division because the solo taught group was much higher on average. The results did suggest that the two groups were compatible in the Multiplication unit.

To further analyze the data, a series of unpaired t test were done to determine if a statistical difference was shown for the same three units. The data revealed mixed results in the post test. For the multiplication unit, solo teaching showed that it had a more positive effect than co-teaching on student's achievement. Number Sense did not show any statistical difference, but it did show that the co-taught group improved significantly and that the gap was closed. Additionally, this supports that co-teaching was more effective than solo-teaching in improving student learning of Number Sense. The division unit showed a significant difference in pre test scores and this gap remained significantly different in post test scores. In addition, there was no significant difference between co-teaching and solo-teaching on student learning in Division.

The hypothesis is supported because co- teaching and solo teaching do have different effects on student math achievement. Also, it was proven that co-teaching had a more positive effect on fourth grade math achievement in the Number Sense unit only.

The results show that co-teaching and solo teaching were both beneficial to the students that were within those learning environments with the exception of the division unit. This research supports that co-taught classrooms benefit all students as supported by research conducted by Abdallah (2009). Since the results were mixed both sides of the argument must be supported. Dieker, 2001; Mastropieri, Scruggs, & Graetz, 2005; Walther-Thomas, 1997 showed through their research that co-teaching increases time task engagement, but does not automatically lead to increased academic achievement.

Limitations of the Study

The study yields possible limitations that may negatively affect the validity/reliability of it. For example, it's not an experimental study as no random selection/assignment of participants is involved. The students were chosen by availability. The general education was chosen based on her previous experience in co-taught classes and her willingness to cooperate with the researcher. Also, teacher bias for being both teacher and researcher causes issues in validity due to the lack of involvement in the research due to other job requirements. Both of the teachers were absent a great deal due to job related trainings and other obligations which lead to loss of instruction and teacher inconsistency due to lack of planning. In some instances, there were too many days between pre-test, instruction, and post-test. All of these issues raise a great deal with the reliability of this action research project.

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