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Measuring the Impact of Three Different Co-Teaching Models on Student Test Results in Ninth-Grade Algebra I

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Measuring the Impact of Three Different Co-Teaching Models on Student Test Results in Ninth-Grade Algebra I

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Dedication

To my family. Your unwavering support has been critical to my success! Thank you for pushing me, supporting me, and loving me throughout this journey. This degree is as much yours as it is mine. I am so incredibly lucky to welcome a plethora of new doctors to the field and am forever thankful to know that I have all of you in my corner. My friends and colleagues, your humor throughout this process has reminded me that life keeps moving forward, and you need to be able to take time to enjoy it. To my team, thank you for helping me “trust the process,” even when it seemed like a never-ending journey. To the students of New Roads, thank you for illustrating that inclusion does work! Finally, to Dr. Siebert and Dr. Lyons, there are not enough words to describe what your support has meant over these past few years. Thank you for your unwavering guidance and for helping me navigate this journey.

Biographical Sketch

Amy Marie Cermele is currently a Special Education Teacher in New York State. Ms. Cermele attended Pace University from 2000 to 2004 and graduated with a Bachelor of Arts degree in Adolescent Education and History in 2004, and she graduated with a Master of Science degree in Special Education from Pace University in 2007. Ms. Cermele attended the College of St. Rose from 2012-2014 and graduated with a Master of Science degree in Educational Administration. She came to St. John Fisher College in the summer of 2015 and began doctoral studies in the Ed.D. Program in Executive Leadership. Ms. Cermele pursued her research in measuring the impact of different co-teaching models on student test results in ninth-grade algebra under the direction of Dr. Robert Siebert and Dr. Janet Lyons and received the Ed.D. degree in 2017.

Abstract

The purpose of this retrospective case analysis was to see if post-exam Algebra I mathematics scores were impacted in any way by the utilization of three different models of co-teaching: “interventionist,” “specialist,” and “departmentalized.”

Two years of archival pretest and posttest exam scores from classified and non-classified student exams were used to determine the overall mean growth for students who were educated in these instructional models. The data revealed that all co-teaching models produced statistically significant results for all students. However, the model that consistently produced statistically significant outcomes was the interventionist model.

Recommendations for the selected district are to continue to utilize these instructional models because they produce statistically significant mean changes for students with and without disabilities. However, more quantitative research, such as a longitudinal study is recommended to compare the results from this study. Further research should focus on the specific disabilities of the students within each instructional model. It would be interesting to note if students with a specific educational disability performed better in any of the selected models.

Finally, it is recommended that lawmakers and policymakers use this research to advocate for co-teaching to be included on the continuum of services for students with educational disabilities. This research helps to illustrate that co-teaching produces statistically significant growth for all students.

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Chapter 1: Introduction

Co-teaching, as described by Walsh (2012), serves as "an alternative education approach in which general and special education teachers share teaching responsibilities and provide differentiated instruction for academically and behaviorally diverse students in the least restrictive setting" (p. 29). This instructional approach is used by many different schools to instruct and engage learners who have a variety of backgrounds and academic needs.

Co-teaching and the idea of including students in classrooms, who may learn differently than others, has been around since the time of Lev Vygotsky (trans. 1965) in the late 1800s. He was one of the pioneers around the idea of the social learning theory and the notion that people can complete tasks at a comparable level when provided with support, modeling, and interactions from peers and adults. His theory centers around the idea that when people are placed in situations to learn and work with one another, they perform better (Vygotsky, trans. 1965).

Friend, Reising, and Cook (1993) completed a vast amount of research on co-teaching. As an instructional model, it began in the 1950s as a version of team teaching in which two teachers worked together in the same classroom and educated the same group of students. This model was used in the US and England. In the 1950s, the class sizes were large, with upwards of 50 students, as there were no set requirements regarding class size. This approach of two instructors in a room allowed for full group instruction, which could be followed by small group work to help meet individual student needs.

Co-teaching gained importance with the first incarnation of federal legislation that focused on creating opportunities for students with disabilities entitled, the Education for All Handicapped Children Act of 1975 or Public Law (PL) 94-142. Throughout American history, people with disabilities were excluded in a variety of social domains, including education. “In 1970, more than 1.75 million students with disabilities were completely excluded from public school. Those few who were deemed ‘educable’ received their instruction in ‘special’ self-contained classrooms and segregated schools attended only by other students with disabilities.” (TASH, 2009, p. 1).

Advocates for people with disabilities were looking for ways to create policies to increase access and participation in various social domains, in particular, education. Based on the lack of equality and access for students with disabilities, this law was passed to make inclusive education the norm around the country.

PL 94-142 introduced new requirements regarding the inclusion and education of students with disabilities within their community school. These requirements were grounded in the two major concepts regarding the education and protection of students with disabilities (U.S. Department of Education [USDOE], 2004b).

The first requirement in PL 94-142 guarantees a “free, appropriate public education” (FAPE) (USDOE, 2010, para. 5) for every child, regardless of any physical or mental incapacity, limitation, or disability that affects learning. It also means that no parent of a disabled child can be charged or required to pay additional taxes, fees, etc., that result from the extra cost of the child’s educational program.

The second concept or requirement is that of the least restrictive environment (LRE). This means that, whenever possible, students with disabilities are to be educated with their non-disabled peers in their home district and in a classroom that is teaching the general education curriculum to all students (New York State Education Department [NYSED], 2015).

The passage of this federal mandate, and all subsequent reauthorizations, constantly challenge schools to provide academically rigorous classes for all students. One way schools have tried to meet this challenge and the legal mandate of FAPE and LRE is by using a co-teaching model in which a general education teacher, as well as a special education teacher, deliver shared instruction to students of diverse educational needs within the general education curriculum.

Co-teaching has been in use for many years; yet, what do we know about co-teaching's impact on student achievement? Much of the research currently in the field speaks to the attitudes and perceptions of staff and students after they have participated in these models (Boyd, 2013; Pham & Murray, 2015; Sears, Brawand, Eichorn, Jenkins, & Preston-Smith, 2014). The research highlighted that teachers enjoy working in an inclusionary model when they can select with whom they work as well as being provided with common planning time. Students generally reported that they enjoyed the larger classes as well as the support of the teachers.

There is very little quantitative research that measures the effectiveness of co-teaching. The studies that do exist, such as Walsh (2012), view the effectiveness of co-teaching from the elementary perspective. Even the meta-analyses that have been completed have inconclusive results because the number of quantitative studies is so low.

Although we know so little about the instructional effectiveness of high school co-teaching models, educators consistently employ these models to help all students, including special education students, take and pass high-stakes exams required for graduation. This reliance on co-teaching is particularly evident in the area of high school mathematics instructions.

All students in New York State (NYS) are required to pass a math Regents exam in order to fulfill state requirements to graduate with a Regents diploma. The math exam considered to be the most important to pass is ninth-grade Algebra I.

Algebra has been linked to success and matriculation in post-secondary education. “Mathematical structures form the basis of our number system and provide the underlying foundation” (Christy & Sparks, 2015, p. 37). Mathematics, in particular algebra, provides foundational skills for students. In 2001, Rose and Betts (2001), identified the correlation between high school curriculum, college graduation, and earnings. The results of their study showed that “Math curriculum has a strong effect on the probability of graduating from college” (p. xix).

Snipes & Finkelstein, in 2015, stated that “mastery of algebra in particular is a critical step to enrollment and success in a college preparatory math sequence that can include trigonometry, pre-calculus, and calculus” (p. 1). All of this research highlights the need for continued focus on algebra.

“Algebra acts as gatekeeper for high school graduation and post-secondary success. Students who pass Algebra I by the end of ninth grade are more likely to take advanced mathematics courses, graduate from high school, and succeed in college” (UIC Research on Urban Education Policy Initiative Policy, 2013, p. 3) “Simply stated, content associated with Algebra I is notoriously difficult compared with the number and operations concepts concentrated in earlier grades" (p. 3). The above statements continue to describe the need for algebra instruction that reaches all learners.

This quantitative study focused on three co-teaching instructional models that are used in ninth-grade algebra classes in an urban setting in Westchester County, NY. One configuration is the specialist co-teaching model in which a special education teacher, who is also math certified, co-teaches with a Grade 7-12 math-certified teacher. In this model, a certified content teacher supports within each different academic class, that is, English, math, social studies, and science. One of the four special education teachers further supports the students in a self-contained academic-support class. This model has been in place in the selected district for over 10 years.

Another local co-teaching model is the interventionist model. In this pairing, an individual who is New York State certified in special education stays with the same group of classified students in all of their academic classes, English, math, social studies, and science. This special education teacher is not certified in mathematics. He or she is paired in the classroom with a general education teacher who is certified in the content area being taught. The special education teacher further provides support within a self-contained academic support class. This model has been in place in the local district since 2013.

The final model for the purposes of this study is the departmentalized model. In this model, a teacher who is certified in Science 7-12 co-teaches Algebra 1 with a Grade 7-12 certified math teacher. As described by NYS Department of Education Regulations (Thomson Reuters Westlaw, 2017), this is allowed as:

> A superintendent of schools may assign a teacher to teach a subject not covered by such a teacher's certificate or license for a period not to exceed five classroom hours a week, when no certified or qualified teacher is available after extensive and documented recruitment, and provided that approval of the commissioner is obtained in accordance with requirements. (para. 1).

By completing an archival study of 2 years of student test results, this research sought to determine if either of the local models were more effective in terms of student outcomes than the single-teacher, regular-education classroom. This study reveals if either of the models had an impact on student test results.

Problem Statement

"Accepted as a gatekeeper, algebra has been a major focus for school mathematics programs. The basic reason may be the power that algebra has provided for operating with concepts at abstract levels and applying these concepts in concrete situations" (Erbas, 2005, p. 25). As a result, this study is concentrated on the co-teaching models and if one is more effective than the others in producing better student outcomes.

To graduate from high school in New York State, there are set requirements a student must meet. One requirement is that a student must obtain a score of 65 or higher on the math Regents exam. Based on the current data available from NYS, the special education students enrolled in the high school who were used for the study were not progressing toward achievement in algebra in comparison to their general education peers. The algebra Regents exam was administered to 786 students. Over 76%, or 411, general education students passed the algebra Regents exam with a score from 65-84, compared to 37%, or 48, special education students who passed with a score between 65-

84. This disparity between student outcomes highlights the need to determine if the instructional models that are designed to support special education student needs in Algebra I are effective (NYSED, 2016).

These local results are very similar to the NYS data, as a whole, as recorded in the 2014-2015 NYS Report Card (NYSED, 2016). This report card reveals that 115,589 students took the algebra Regents exam. Of that total, 85,748 test takers were general education students. Of all of the students taking the exam, 70%, or 59,609, received a passing score of 65 or higher. Of the total test takers, 29,841 were students with disabilities. Only 39% of the students with disabilities scored a 65 or higher (NYSED, 2016). Both the local and state-wide data illustrate that students with disabilities are severely underperforming in Algebra I, compared to their non-classified peers.

Given that there is a significant additional resource allocation required to staff these co-teaching classrooms, and given the significant disparity in test results, there is a need to determine what impact, if any, the co-teaching instructional models being researched are having on student pass rates and on fulfilling the goals of special education law. This study examined this problem through a quantitative analysis of the data.

Statement of Purpose

Most research on co-teaching models focuses on teacher beliefs and perceptions regarding how teachers collaborate and work with one another. There is very little research on the actual instructional effectiveness of these co-taught classrooms in terms of student test outcomes. The purpose of this study was to focus on student test data in order to determine the impact co-teaching models have on ninth-grade Algebra I results on the growth rates of classified and non-classified students assigned to these classrooms.

This quantitative analysis helps to fill a void in the research on the effectiveness of high school co-teaching when judged by student test outcomes. School districts need to know if the models employed in high schools have been successful in furthering the goal of student success in mathematics. Districts have utilized these instructional models for years, and yet, there is scant data or evidence to suggest that they are any more successful than the traditional, general education model in advancing the growth of students in algebra.

Potential Significance of the Study

This research will be used to inform current special education instruction, resource allocation, and staffing in a suburban city school district. By performing a quantitative study, the researcher was able to determine if any of the models are achieving better results for students with disabilities, compared to their non-classified peers. This research helps to determine the relative effectiveness of the existing programming and identify if the district needs to implement other instructional models that might produce better student outcomes.

After reviewing the study, some of the considerations for the local district would be the hiring and deploying of certified staff, professional development, and training of teachers to support special education students. With so little attention paid to student test results correlated to co-teaching models, policy makers, administrators, and special education instructional staff could benefit from this study.

Theoretical Rationale

There are many theories that describe how people learn in groups or social settings. One of the major theories that describes the way people act and interact in group situations is by Lev Vygotsky (trans. 1965), which is entitled social constructivist theory. Constructivism is a theory that attempts to explain the way people learn or develop. Social constructivism can be described as socialization, a process of acquisition of skills, knowledge, and dispositions that enables an individual to participate in his or her group or society. "This socialization process consists of reciprocal interactions and joint construction of meaning by the individual and others in the social context" (Sivan, 1986, p. 211). Social constructivism looks at the interactions of students as they engage with their peers and with adults to help them gain meaning and understanding.

A fundamental tenet of constructivism is that learners play an active role in their own development. In fact, Vygotsky (trans. 1965) suggested that learning precedes development, noting that it is only after children have the opportunity to observe and approximate a new skill and practice it, with the help of more capable peers, that they eventually incorporate it into their own cognitive constructs (Mallory & New, 1994).

According to the constructivist theory, placing students in social environments where they can have appropriate peer and adult role models helps them achieve success. Students and people learn best when they are able to *construct* or *build* their own knowledge. The social aspect of working and learning from a variety of people helps students to make their own connections and gain a better understanding of concepts at large.

For students to develop their knowledge, Vygotsky (trans. 1965) described a zone of proximal development (ZPD). The term *zone of proximal development* is defined by Vygotsky as "the distance between the actual development level as determined by independent problem solving and the level of potential development as determined through problem solving under adult guidance or in collaboration with more capable peers" (Vygotsky, 1978, p. 86). Another way to describe this theory is the "distance between what a learner can do alone, and his or her potential ability when guided by adult or more capable peers" (Purzer, 2011, p. 657). This means that placing students in an environment where they are provided with supports and asked to complete work that may be at more rigorous levels can be achieved, which is due to ZPD. Working with the supports provided by adults or appropriate peer models would help them achieve success. Vygotsky (trans. 1978) stated that:

> An essential feature of learning is that it creates the zone of proximal development; that is, learning awakens a variety of internal developmental processes that are able to operate only when the child is interacting with people in his environment and in cooperation with his peers. Once these processes are internalized, they become part of the child's independent developmental achievement. (p. 90)

Vygotsky (1978) utilized ZPD to explain why students need to be placed in educational settings with adults and capable peers. By having appropriate academic models, students are able to learn more and better understand concepts. ZPD allows students with the opportunity to work with support personnel until they can internalize the knowledge for themselves.

ZPD allows students to have access to the information and content being taught, while they benefit from the socialization and support provided by another teacher or peer. The socialization and conversation that occur when learning the content allows students to retain the information presented and to construct their own meaning through peer and staff interaction.

"According to Vyogtsky (1978), the construction of knowledge is a social process, and group learning experiences expand students' abilities beyond what they can individually do" (Purzer, 2011, p. 657). This theory helps to support the notion that whole-group instruction with students of a variety of levels, commonly referred to as a heterogeneous grouping, is beneficial for all. Students can meet and interact and support one another as they learn classroom content.

The idea of constructivism, or building and creating your own knowledge, also has its roots in the works of Piaget (1954). "One of Piaget's (1954) most important discoveries was to demonstrate how a child progressively constructs the idea of permanent objects that continue to exist outside of his or her experience" (Elkind, 2005, p. 328). Although Piaget (1954) and Vygotsky's (1978) theories both became widely known and respected around the same time in history, the distinct difference between the theories is that Piaget spoke about the four stages one must go through when learning.

The four stages that Piaget (1978) wrote about deal with the development of children as they begin to amass their own knowledge. The four stages are "sensorimotor, preoperational, concrete operations, and formal operations" (Simatwa, 2010, p. 367). These stages describe how learning for children occurs based on the child's development. One can see the correlation between Piaget (1968) and Vygotsky (1978) in the notion that when provided with supports from adults and non-disabled peers, students with educational disabilities are able to achieve greater educational growth than if they remained in a self-contained environment with only disabled students. These stages link directly to Vygotsky (1978) because it illustrates that with support students are able to achieve a higher level of learning.

While going through the stages of learning, one would activate *schema* or prior knowledge to build upon. Vygotsky's (1978) theory focuses on the role socialization plays in helping people to generalize their knowledge and internalize it to make it last. This theoretical construct supports the design and implementation of co-teaching models.

Research Questions

This study was guided by the research questions, along with null and alternative hypotheses.

1. Is there a difference in student outcomes in Algebra I for non-classified students enrolled in the interventionist co-teaching, specialist co-teaching, or departmentalized instructional model?
   (a) H1, Null Hypothesis 1: There is no difference in student outcomes in Algebra I for non-classified students enrolled in the interventionist co-teaching, specialist co-teaching, or departmentalized instructional model.
   (b) H1, Alternative Hypothesis 1: There is a difference in student outcomes in Algebra I for non-classified students enrolled in the interventionist co-teaching, specialist co-teaching, or departmentalized instructional model.

2. Is there a difference in student outcomes in Algebra I for classified students enrolled in the interventionist co-teaching, specialist co-teaching, or departmentalized instructional model?
   (a) H2, Null Hypothesis 2: There is no difference in student outcomes in Algebra I for classified students enrolled in the interventionist co-teaching, specialist co-teaching, or departmentalized instructional model.
   (b) H2, Alternative Hypothesis 2: There is a difference in student outcomes in Algebra I for classified students enrolled in the interventionist co-teaching, specialist co-teaching, or departmentalized instructional model.
3. What is the average growth, if any, for students in ninth-grade Algebra I who are enrolled in the interventionist co-teaching, specialist co-teaching, or departmentalized co-teaching instructional model over a 1-year period.

Definitions of Terms

Autism – a disability classification in special education law that is defined as a developmental disability significantly affecting verbal and non-verbal communication and social interaction, generally evident before age 3, that adversely affects a student's educational performance. Other characteristics often associated with autism are engagement in repetitive activities and stereotyped movements, resistance to environmental change or change in daily routines, and unusual responses to sensory experiences (NYSED, 2015).

Class size – the number of students in a room of instruction (NYSED, 2015).

Committee on Special Education (CSE) – a multidisciplinary team that meets to create an Individualized Education Program for a student with a classified disability and to determine if a student is eligible for, and can benefit from, special education services and programs (NYSED, 2015).

Departmentalized Model – an instructional structure in which a certified special education and biology teacher 7-12 co-teaches Algebra I with a certified general education mathematics teacher in Grades 7-12.

Free Appropriate Public Education (FAPE) – a legal right under the Individuals with Disabilities Act (IDEA) to which special education students are entitled. An appropriate education may comprise education in regular classes, education in regular classes with the use of related aids and services, or special education and related services in separate classrooms for all or portions of the school day. Special education may include specially designed instruction in classrooms, at home, or in private or public institutions, and it may be accompanied by related services, such as speech therapy, occupational and physical therapy, psychological counseling, and medical diagnostic services, necessary to the child's education (NYSED, 2015).

General Education – classrooms in which teachers teach the general (non-modified) curriculum and the students are not co-taught, instead, they are solely taught by one general education teacher (NYSED, 2015).

Highly Qualified Teacher (HQT) – instructors in middle and high school who demonstrate knowledge of the content area they teach through either credits equivalent to a major in a subject; passage of a state-developed test; an advanced certification from the state, or a graduate degree (USDOE, 2004a).

Individualized Education Program (IEP) – a written statement, developed, reviewed, and revised that includes the components mandated to meet the unique educational needs of students with disabilities and the goals to be achieved for the students (NYSED, 2015).

Interventionist Model – a co-teaching model in which one special education teacher is paired with a certified Grade 7-12 content area teacher (math, social studies, English, and science) to form a co-teaching team in each discipline. The special education teacher stays with and supports the students in all academic classes. They further provide the support to the students within in a smaller self-contained academic support class.

Learning Disability – a classification in special education law that is defined as a disorder in one or more of the basic psychological processes involved in understanding or in using language, spoken or written, which manifests itself in an imperfect ability to listen, think, speak, read, write, spell, or to do mathematical calculations. The term includes such conditions as perceptual disabilities, brain injury, minimal brain dysfunction, dyslexia, and developmental aphasia. The term does not include learning problems that are primarily the result of visual, hearing, or motor disabilities; an intellectual disability; an emotional disturbance; or an environmental, cultural, or economic disadvantage (NYSED, 2015).

Least Restrictive Environment (LRE) – along with FAPE, LRE is a core guiding legal principle of special education law. LRE ensures that the placement of students with disabilities in special classes, separate schools, or other removal from the regular educational environment occurs only when the nature or severity of the disability is such that, even with the use of supplementary aids and services, education cannot be satisfactorily achieved (NYSED, 2015).

New York State Report Card – a document produced yearly for every school in New York State as well as the for the state as a whole. This document outlines student and staff demographics as well as performance on state exams (NYSED, 2016).

Other Health-Impairment (OHI) – a disability classification in special education law that is defined as having limited strength, vitality, or alertness, including a heightened alertness to environmental stimuli that results in limited alertness with respect to the educational environment, which is due to chronic or acute health problems, including but not limited to a heart condition, tuberculosis, rheumatic fever, nephritis, asthma, sickle-cell anemia, hemophilia, epilepsy, lead poisoning, leukemia, diabetes, attention deficit disorder, attention deficit hyperactivity disorder, or Tourette's syndrome, which adversely affects a student's educational performance (NYSED, 2015).

Regular Education Teacher – an instructor for a school-aged student who is certified to serve non-disabled students by providing regular education instruction to the student (NYSED, 2015).

Social Constructivism – a process of acquisition of skills, knowledge, and dispositions that enables an individual to participate in his or her group or society. This socialization process consists of reciprocal interactions and joint construction of meaning by the individual and others in the social context (Sivan, 1986).

Special Education Law PL 94-142 – original federal legislation passed in 1975 that guarantees specially designed individualized or group instruction or special services or programs, as defined in subdivision 2 of section 4401 of the Education Law, and special transportation, provided at no cost to the parent, to meet the unique needs of students with disabilities.

1. Such instruction includes but is not limited to that conducted in classrooms, homes, hospitals, institutions, and in other settings.
2. Such instruction includes specially designed instruction in physical education, including adapted physical education (NYSED, 2015).

Special Education Teacher – a person, certified or licensed, to instruct students with disabilities in accordance with the students' IEP (NYSED, 2015).

Speech or Language Impairment – a disability classification in special education law, indicating a communication disorder, such as stuttering, impaired articulation, language impairment, or a voice impairment that adversely affects a student's educational performance (NYSED, 2015).

Specialist Model – a co-teaching design in which a special education teacher, who is also math certified, co-teaches with a Grade 7-12 math-certified teacher. In this design, a certified general education, Grade 7-12 content-area certified teacher is teamed with a special education teacher also certified in the same content area (English, math, social studies, and science). One of the four special education teachers that further supports the students within a self-contained academic support class.

Student-Teacher Ratio – the maximum number of students who can receive instruction together in a special class or resource room program, and the number of teachers and supplementary school personnel assigned to a class as mandated in the students' IEPs (NYSED, 2015).

Student with a Disability – a school-aged child with a disability as defined in section 4401(1) of the U.S. Federal Education Law, who has not attained the age of 21 and who, because of mental, physical, or emotional reasons, has been identified as having a disability and who requires special services and programs approved by the Committee on Special Education and School District (NYSED, 2015).

Zone of Proximal Development – the distance between what a learner can do alone and his or her potential ability when guided by an adult or more capable peers (Purzer, 2011).

Chapter Summary

Co-teaching is a service model that delivers education to students with and without disabilities within a general education setting. The instruction is delivered jointly by both a special education and a general education teacher. This study focused on three different models of co-teaching and compared the test outcomes to one another of students enrolled in these models. The test outcomes were analyzed for both students with disabilities as well as general education students.

This research may be used at the local level to help determine which model, if any, produces better student outcomes on the Algebra I Regents exam. Data can be used retrospectively and reviewed from the 2013-2014 and 2014-2015 academic school years. By using pretest and posttest assessments, the researcher was able to note if any of the models produced better student outcomes.

Chapter 2 discusses the literature that exists regarding co-teaching. There is also a discussion of the historical context regarding co-teaching and how it came to be used, in addition to the perceptions and attitudes from various stakeholders regarding the use of co-teaching. The research design, methodology, and analysis is discussed in Chapter 3. Chapter 4 presents a detailed analysis of the results and findings, and Chapter 5 discusses the findings, implications, and recommendations for future research and practice.

Chapter 2: Review of the Literature

Introduction and Purpose

Students with disabilities consistently fall behind their general education peers on standardized tests, particularly in mathematics. The purpose of this study was to look at test results of students enrolled in three different co-teaching models that were serving students with disabilities. Co-teaching is used by many schools as a way to provide access and support to the general education curriculum for students with educational disabilities. This study helps to determine if either of the local co-teaching models: interventionist, specialist, or departmentalized are producing better student outcomes. In order to better understand the topic of co-teaching, the researcher conducted an extensive review of the literature surrounding co-teaching.

Historical Context of Special Education Law

In this section, the researcher reviews the context in which special education law was created and developed. There are many dimensions to special education law that specify the various educational supports that must be provided to students with educational disabilities.

Civil rights legislation. Civil rights in America are enumerated in the Bill of Rights and various other amendments to the Constitution; but, in the Constitution of the United States, the word *education* does not appear and is not explicitly identified as a civil right or a federal government responsibility. Throughout most of American history, education has been considered a local and state responsibility. As a result, states and localities have implemented their educational programs as they have deemed necessary to meet the needs of their communities.

Civil rights and the concept of *equal protection under the law* was dealt a significant setback at the end of the 19th century as a result of the *separate but equal* doctrine embedded in the *Plessy v. Ferguson* Supreme Court Case. The decision in *Plessy v. Ferguson*, on May 18, 1896, made *separate but equal* accommodations, including schools for people of different races, the law of the land. It also left state and local control of education firmly in place for the next 50 years.

In theory, *Plessy* meant that equal funding and allocation of resources would be provided to both African American and White children. According to this argument, as long as the funding and accommodations were equal, separate facilities, could lawfully exist in all domains of society, including schools (Plessy v. Ferguson, 1896). The Supreme Court's ruling that separate but equal was constitutionally sound left the matter of funding and maintaining separate but equal facilities to the individual states. History demonstrated rather dramatically that separate but equal was almost never equal and that funding was woefully inadequate for minority and poor students throughout most states (Brown v. Board of Education, 1954).

Then in 1954, the Supreme Court was asked to rule on a case entitled *Brown v. Board of Education of Topeka, Kansas*. In this seminal case, Justice Earl Warren, speaking for the majority, overturned and declared unconstitutional *Plessy v. Ferguson* (1896) and the doctrine of separate but equal. In his decision, the Chief Justice asked, "Does segregation of children in public schools solely on the basis of race, even though the physical facilities and other "tangible" factors may be equal, deprive the children of the minority group of equal educational opportunities? We believe that it does." (*Brown v. Board of Education of Topeka, Kansas*, 2016, para. 13). The majority held that even if funding and facilities were equal (which they clearly were not) segregating children on the basis of skin color, deprived them of equal educational opportunity. This monumental decision led to the integration of the public schools because segregation by race was declared unconstitutional. Importantly, this decision increased the federal role in public education and made the president and government in Washington responsible for enforcing equal access to educational opportunities for all students regardless of race (*Brown v. Board of Education*, 1954).

The overturning of *Plessy v. Ferguson* (1896) galvanized the nation around education as a civil right. No longer was the federal government willing to leave the matter of equality to individual states. Emboldened by the success of this civil rights movement, families and advocates for students with disabilities began to advocate for equity and access in society and education.

Individuals with Disabilities Education Act (PL 94-142). Special education law in the United States traces its history to civil rights legislation and the idea that all students, regardless of their socioeconomic status, gender, race, or disability, are entitled to an education to help them achieve success. One of the earliest school reform movements regarding students with disabilities came out of President Lyndon B. Johnson's administration. Passed in 1965, the Elementary and Secondary Education Act (ESEA) was created "to provide financial assistance to local educational agencies serving areas with high concentrations of children from low-income families to expand and improve their educational programs by various means" (Thomas & Brady, 2005, p. 4).

This was one of the first educational reforms created by the federal government to help equalize and provide access for all students. This came out of President Johnson's Great Society Program in which he created many social initiatives to help equalize access and opportunity for all Americans.

The first major federal law that focused on creating opportunities for students with disabilities was entitled the Education for All Handicapped Students, also known as IDEA or PL 94-142. Passed in 1975, this federal law introduced new concepts regarding the inclusion and education of students with disabilities within their community schools. Prior to the passage of this law, students with disabilities were typically educated in segregated environments in schools and sometimes not even educated within their own community (USDOE, 2012). The major purposes of PL 94-142 included:

- To assure that all children with disabilities have available to them a free appropriate public education designed to meet their unique needs.
- To ensure the rights of children with disabilities and their parents' rights are protected.
- To assist states and localities to provide for the education of all children with disabilities
- To assure the effectiveness of the effort to educate all children with disabilities.
- To assure that students with disabilities are educated in the least restrictive environment with access to general education curriculum and peers within their home district (USDOE, 2012).

This law was the first federal law that governed and allowed for the protection of students with disabilities. PL 94-142 requires that when looking for a classroom placement for a child with a disability, one must consider how much time the child can spend in the general education environment with their typical peers within their community school. The law mandates that the schools create opportunities and access for all students to succeed alongside their typically developing peers. Only in rare cases should students be placed in segregated environments outside of their home school.

This landmark legislation and all subsequent reauthorizations have helped to create the inclusive nature of special education that many of our current schools practice. The concepts of free and appropriate education and of least restrictive environments have helped to bolster the support for programs such as integrated co-teaching. Having students of different skill sets and areas of strength grouped together allow them to learn from one another and work with teachers who possess the expertise to help them achieve success (Vygotsky, trans., 1978).

In 2004, PL 94-142 was reauthorized. It continued to use LRE and FAPE as cornerstones but further added to the body of requirements in special education by including the concept of highly qualified teachers (HQT) (IDEA Partnership, n.d.). This law made states accountable to ensure that secondary teachers of special education students would hold and maintain certification in a content area (math, science, English social studies) along with certification in *students with disabilities*.

This was a push by the federal government to link the ideals of IDEA with the federal law of No Child Left Behind (NCLB) (2002). Both laws were passed under the administration of President George W. Bush. NCLB (2002) "put a special focus on ensuring that states and schools boost the performance of certain groups of students, such as English-language learners, students in special education, and poor and minority children, whose achievement, on average, trails their peers" (Editorial Projects in Education, 2015, para 6).

This federal mandate made schools responsible and accountable for the test performance of their student populations (Editorial Projects in Education Research Center, 2015). Under this law, schools are held responsible in terms of individual student growth as well adequate yearly progress (AYP). AYP measures the yearly progress for students in particular subgroups, including students who are eligible for a free and reduced-fee lunch, as well as students with disabilities and English as a New Language students (NYSED, 2015). These laws opened the door to a significant increase in federal government involvement in education.

The latest law to be passed by the federal government that impacts all students is the Every Student Succeeds Act (ESSA) (USDOE, 2015). This law was built upon all the work completed by the federal government regarding improving educational outcomes for all students. The law aims to provide *college and career ready skills* for all students while continuing to close the achievement gap for students based on a variety of factors including race, disability, gender, socioeconomic status, and geography (USDOE, 2015).

Concerns Regarding IDEA

Although progress has been made in terms of legislating educational access for students with disabilities, criticism remains. "In spite of these (federal) mandates, surprisingly little progress has been made nationally toward educating students with disabilities in general education classrooms" (McLeskey & Waldron, 2007, p. 279). This quote illustrates that even with inclusive practices being mandated by the federal government, many schools are not providing equal access for all students in a general or inclusive education settings.

One of the ironies associated with IEPs is that classrooms are often created for groups of students with similar academic and cognitive profiles, which are sometimes referred as *one best place* rather than creating educational opportunities for the individual student. “The bedrock of special education is instruction focused on individual needs. The very concept of “one best place” contradicts this commitment to individualization” (Zigmond, 2003, p. 196). This illustrates a concern regarding special education. When schools create programs for a whole group of classified students, it challenges the idea of special education recommendations being made for the best results of each individual child. Schools, create programs and set criteria for students who should *do well* in that program, rather than designing and implementing programs and classes that are truly individualized to meet a student’s needs.

In 1999, Hornby presented another concern regarding the implementation of IDEA and its mandates, namely, that:

> There is little evidence that the goals of inclusion are being met. It appeared that greater educational attainment, increased social skills, reduced stigma, greater racial integration, improved parent involvement, and individualization of instruction did occur with IEP implementation, but did not necessarily result from including children with disabilities in mainstream schools. (p. 154)

Hornby stated that typically classified students mainstreamed in general education settings receive educational support to help them attain an increased level of education, yet there is no research to illustrate if mainstreaming or inclusion are effective in helping classified students meet their academic goals. The research does highlight that co-teaching positively impacts students' social/emotional well-being, yet the data is less convincing when it comes to impacting academic performance.

Hornby (1999) also explained the history of inclusion models in both the United States and the United Kingdom. His review of the literature on inclusion revealed that "the trend towards including more children in mainstream schools is accelerating, but there is still a substantial portion of children in segregated placements. There remains a lack of evidence for the effectiveness of inclusive practices" (p. 155). Much of the research focuses on the concerns of the educators, rather than the effectiveness of the models.

Zigmond (2003) raised another concern regarding the implementation of IDEA and the subsequent mandates. The article discusses that often researchers and educators have looked at the inclusion model as an *all or nothing* environment. Students are often placed in either a mainstream classroom with support or provided education in smaller self-contained settings.

From the data available in 2003, Zigmond reiterated that the "research base is limited" (p. 195) regarding student achievement in mainstream placements. Further, the research is methodologically flawed and overall inconclusive because there are not enough empirical or quantitative studies to show that LRE is, in fact, beneficial for students academically. The literature review noted that several of the studies that had been completed did not identify the impact these models had on student achievement.

Zigmond (2003) further stated that "educators must also remember that research has shown that typical general education environments are not supportive places in which to implement what we know to be effective strategies for students with disabilities" (p. 198). "Although a student with an educational disability is learning alongside her typical counterpart, is that student making the progress that they should?" (Zigmond, 2003, p. 199). Are the mandates that drive LRE and FAPE driving us to make plans for students with disabilities based on law and not the needs of the individual child?

Co-Teaching as an Instructional Model

Co-teaching has been used as a model to provide students with educational disabilities access to the general education curriculum. The section below highlights student and teacher perceptions, as well as best practices, regarding this instructional model.

Benefits, concerns, and recommended practices. Walther-Thomas completed a 3-year study in 1997 that focused on 18 elementary schools and seven middle school teams that were all involved in creating inclusionary programs to integrate students with disabilities. The data collection focused on the benefits and problems that emerged during the implementation process.

There were 23 teams that were included in the study from eight school districts. The teams comprised 4-5 people, including a school principal or assistant principal and one or two general education teachers, as well as one or two special education teachers, depending on how the teams were divided. There was a total of 143 participants in the study: 119 teachers and 24 administrators. This was a qualitative study that used college graduate students as observers and interviewers to determine whether any of the models were used.

Teachers in the study reported that these inclusionary models benefitted general education students. Many of the participants also acknowledged that they “supported inclusive special education because it offered them hope that some of the needy but unidentified students they teach will receive additional attention” (Walther-Thomas, 1997, p. 400). This demonstrates some of the unintended benefits that happen when students participate in co-teaching settings.

Hang and Rabren (2009) created a longitudinal study that investigated student performance before and after their placement in a co-teaching classroom. Surveys, observation, and record reviews were used to gather data. The selected group of participants included 45 co-teachers, as well as 58 students with disabilities, in the selected district. All students and staff were from the elementary schools within the district, and this was their first year participating in co-teaching. It was a mixed-methods study that used archival and the most current test data to measure the growth of students as well as interviews and a survey to note qualitative information. The study did note that immediately after co-teaching, there was a significant impact of .01 in terms of student growth on state exams because .01 illustrates a strong statistical correlation (Hang & Rabren, 2009). However, the researchers further noted that “after 1 year of co-teaching, [there was]no significant differences in academic achievement, as measured by SAT [and] NCEs” (Hang & Rabren, 2009, p. 265), which are the state exams used to measure student progress. The Hang and Rabren study shows that co-teaching had an immediate impact on student performance, yet 1 year after their participation in the model, no major gains were noted.

Hang and Rabren (2009) also identified that there were statistically significant differences in discipline referral and school absence records during the co-teaching year, compared with the records of students in the previous year when they did not experience co-teaching. The researchers noted that students participating in co-teaching classes had better attendance once they were placed into a co-teaching setting (Hang & Rabren, 2009). This study highlighted that co-teaching does positively impact student performance at least in the first year after not being taught in a co-teaching classroom, as well as showing a decrease in behaviors that could be considered problematic both in the classroom and for student achievement.

The impact of co-teaching at the secondary level was studied by Fore, Hagan-Burke, Burke, Boon, & Smith (2008). In this study, the researchers looked at student placement and outcomes in both inclusive and non-inclusive classrooms. Fore et al. (2008) selected 57 high school students who were assessed using the Multilevel Academic Survey. The results they gathered showed no major difference in the results on the exam when based on student placement in an inclusive or non-inclusive classroom. They further stated that “our findings are consistent with previous research reporting that class placement for students with disabilities did not correlate with academic achievement” (p. 65). This study illustrated that no matter what educational setting in which students were placed, there did not appear to be a correlation related to higher grades on assessments.

The study did show that students with higher socioeconomic status, whether classified with a disability or not, performed higher, overall, longitudinally than their peers with lower socioeconomic status. The study did not correlate that the impact was due to the educational placement of the student but, rather, that the correlation to higher achievement was made based on the socioeconomic status of the student.

In 2009, McDuffie, Mastropieri, and Scruggs completed a study using a sample of 203 seventh-grade science students with and without disabilities, in a co-teaching and non-co-teaching setting over an 8-week period. The study was conducted using eight classrooms in an urban school in Chicago. Four inclusive science classrooms and four non-inclusive classrooms were chosen for the study. The researchers examined the four main classroom configurations that were selected. They were "(a) co-taught classes with peer tutoring, (b) co-taught classes without peer tutoring, (c) non-co-taught classes with peer tutoring, and (d) non-co-taught classes without peer tutoring" (McDuffie et al., 2009, p. 496).

The sample was selected from two middle schools in two different districts. McDuffie et al. (2009) was a quantitative study in which the researchers were trying to determine if there was a difference in student effects from peer tutoring in co-teaching or non-co-teaching models. A pretest was designed by the researchers using science facts that the students would be exposed to during the intervention. This pretest was provided to all participants in the study.

The results of the McDuffie et al. (2009) study revealed that peer tutoring in a co-teaching setting did not provide any statistically significant results. Because there were four conditions or classroom configurations that were being researched, the treatments to each classroom were randomly assigned. Two models each received the same treatments. A total of six in-class observations were also completed by the researchers. The observational data yielded results that illustrate that in co-teaching, there is a significance in how many more times students with disabilities interact with their teachers, compared to their non-disabled peers. The statistical significance was .01, suggesting that this has a strong statistical value. The study illustrated that although peer-tutoring did not make a major difference in student outcomes, students with disabilities tend to utilize and access their teachers for academic support.

A longitudinal study by Walsh, published in 2012, shows noted academic growth for elementary students, Grades 3-8 in Howard County Schools in Maryland, who participated in an integrated co-teaching model. Walsh (2012) stated that:

> The comparison of overall Grades 3-8 student performance by students with disabilities between 2003 and 2009 on state assessments indicates that students with disabilities increased proficiency in reading at twice the rate (22%) as did students overall (11%) and nearly twice the rate (22%) in mathematics compared with students overall (13%). The achievement acceleration demonstrated over this time period represents a true closing of the achievement gap for students with disabilities within Howard County, largely attributed to the implementation and support of co-teaching. (p. 36)

The Walsh (2012) study speaks to co-teaching producing better results for students in Grades 3-8. Importantly, it shows that students with disabilities were able to achieve at comparable, or higher, levels in comparison to their general education peers when placed in these classrooms.

The impact of co-teaching on post-secondary students was studied in Israel by Wolffensperger and Patkin (2013). The researchers had students and teachers complete a self-assessment to evaluate the outcomes in co-teaching mathematics classrooms at a teacher's education college.

The population for the study included 17 students and two lecturers. Indicators to assess the process of co-teaching were developed by the educators and the students in the class. Mastery level was considered "achieving comprehension performance of a high level and quality" (Wolffensperger & Patkin, 2013, p. 22). The students were rated using a rubric that determined if they met the mastery criteria. Data for this study was collected in several ways.

The students were asked to keep a reflection record to record their self-assessments. This was considered a qualitative research method that involved collaborative self-study. Data was also collected from in-depth interviews with the students. At the end of the term, reviews of student writing assignments by the lecturers were also collected.

Wolffensperger and Patkin (2013) used a grounded theory approach to frame their study. The findings of the study revealed that 10 of 17 students received a grade between 80 and 96%. The other seven students received less than an 80% on their class grade. The results also revealed that the students enjoyed the process of reflecting on their learning as well as having two lecturers in the room. A student reported that by having two lecturers in the room, "I understood much better what I was supposed to do at each stage of the work and how I could monitor my work by writing in my reflection" (p. 28). One of the limitations to this study was that the researchers did not compare students' grades to the grades of students in regular lecture classes.

The lecturers reported that the students did not appear to *buy in* to the process of self-assessment, and it took a variety of approaches on their part to get the students to understand the importance of self-assessment. Overall, though, the lecturers reported that once the students were able to understand the reasons and growth that they would see, they become engaged in the process of self-assessment.

Perspectives of teachers on co-teaching. As previously stated, most research completed on co-teaching focused on the attitudes and perceptions of the faculty involved in the pairing. Several studies examined the various models set forth by Friend, Reising, and Cooke in 1993, and they discussed how they could be used in a pairing. The six pairings described by Friend, Reising, and Cooke (1993) were:

1. One teach, one observe – One of the teachers directs instruction and the other teacher observes in the classroom to observe any student behaviors.
2. One teach, one drift – One main instructor teaches and the other teacher walks around the classroom to support students as needed.
3. Station teaching – Two teachers offer different learning stations to students to access curriculum. Students are able to work in a variety of stations independently as well as in stations with teacher support.
4. Parallel teaching – Both teachers are teaching the content. Students are grouped based on the needs for the individual lesson.
5. Alternative teaching – The teacher provides the content in different models/formats to students.

6. Team teaching – Two teachers deliver the instruction of the content together. (Friend, Reising, & Cooke, 1993)

These are the types of co-teaching that teams engage in when working with students in co-teaching settings.

The instructional models and teaching methods that a team uses has also been the subject of research. Peters and Johnson (2006) went into detail by describing the teaching models they discovered as *primary/supplementary*, similar to one teach/one drift. This means that one of the teachers always leads the lesson while the other teacher supports. This relates to the research done by Friend and Cook (1983) in the beginning of the inclusion movement.

Although, one could argue that this primary/supplementary model is a form of co-teaching, it does not really form a team teaching pairing in which both teachers are teaching together as well as sharing the classroom and the lesson as a team. It appears that for many teams this approach of one teacher as the primary teacher with the other being secondary is a very common model in co-teaching.

Whichever model of co-teaching a team chooses, the team has the ability to group students in order to achieve a smaller student-teacher ratio (Friend & Cook, 2007; Murawski & Dieker, 2008; Walther-Thomas et al., 2000). This is very helpful to note when looking at teacher perceptions regarding co-teaching. In an integrated setting, students have the benefit of working with two teachers, and teachers can work closely with students because there is another teacher in the room to support them.

In 2010, Raviv conducted a study in Israel that examined teacher perceptions regarding integrating students with disabilities into the general education setting. A sample, consisting of 314 teachers, was randomly chosen for participation in the study. The teachers were of both Jewish and Arabic heritage and, on average, had been teaching for 15.5 years. A questionnaire was created and completed by all participants in the study. The results show that educators who have been trained in special education feel better prepared to work with students with disabilities. Teachers who have not been trained in special education, on the other hand, do not feel as comfortable teaching students with disabilities. This illustrates that co-teaching teams with teachers who have the appropriate credentials and training feel more prepared and ready to work in a co-teaching setting.

In 2013, Michelle Boyd published a dissertation regarding the perceptions of urban, secondary co-teachers. The researcher collected data using the “Co-teaching Perceptions Survey” (p. 65). The population for this study was general and special education middle and high school teachers in an urban school district in eastern Virginia. The population size was 235 educators.

Teachers were divided based on years of teaching as well as certification standards. To gain participants, teachers were given an incentive to participate. For participating, their names were entered into a raffle for a gift card. The survey was disseminated using the teachers’ emails. Participants were coded with a specific ID number to prevent the researcher from knowing from whom she collected the results. Boyd (2013) used six questions regarding the teachers’ perceptions regarding co-teaching. The results show that there were differences between successful and unsuccessful co-teaching pairings. Teams that worked together successfully had higher levels of positive perceptions of co-teaching as opposed to teachers in unsuccessful pairings who did not have positive perceptions of the model.

A concern raised in the literature regarding co-teaching was that teachers prepared as content specialists have little knowledge regarding adaptations for students with disabilities (McLeskey & Waldron, 2007; Dieker & Murawski, 2003). Because general education teachers are often not as versed in accommodations and modifications as their special education counterparts, how will they be able to support students with disabilities? This brings up a common concern. With two teachers in a room teaching a content class in an often high-stakes secondary-education classroom, how critical is it that both educators are well versed in both content and differentiation?

"Secondary special educators often are provided strong preparation in learning differences and accommodations but have limited content specific knowledge" (Dieker & Murawski, 2003, para 8). This approach to the roles of the special and general education teacher creates support for co-teaching, but it also raises concern. Given this concern, if a special education teacher is supporting in a class for which he or she is certified, will he or she be as effective as a special education teacher who is certified in both special education as well as the content? "Educators cannot be expected to master all content areas" (Dieker & Murawski, 2003, para. 11). In a public education system that is being driven to show results, how does that impact student outcomes? How does one work in a co-teaching pairing to ensure that the students are learning and that they are engaged in a pairing that is beneficial for both teachers and students?

Much work has been completed in evaluating co-teaching, yet the majority is anecdotal in nature, focusing mainly on the perceptions of the co-teachers who were involved in the pairings. Cook and Friend (1995) included the perceptions of teachers toward administrators and the varied types of co-teaching models implemented in their school. They concluded that co-teaching "increases instructional opportunity for all students, improves program intensity, continually reduces stigma for students with special needs and increases support for teachers and related service providers" (p. 1).

A necessary requirement for the effective co-teaching classrooms is the notion of collaboration between and among all participants. Wiggins and Damore (2006) indicated that "participants who appear to have a prevalence of positive feelings and views towards collaboration and who are consistently engaging in activities beyond defined roles and expectations" (p. 49) derive the most benefit from co-teaching. The research consistently speaks to the idea of a shared responsibility and that in a collaborative co-teaching classroom, all the students work together with the teachers and the staff. The purpose of inclusionary classrooms is to create a setting where all students benefit from the instruction and expertise of everyone in the room (Conderman, 2011).

It is not surprising that the teacher pairings in rooms with a prevalence of positive feelings and views toward collaboration produce better and higher outcomes. This is because the team is cohesive and acts as a unit when planning and instructing lessons. The teams are better able to reach a variety of learners.

Eccleston (2010) chose to focus his research on the assets that the special education teacher can bring to the co-teaching pairing. However, he stated that although special education teachers are the masters of multitasking and helping students achieve success, they "must work smarter" (p. 26). A consistent concern highlighted throughout the research is that teachers say they do not have enough time to collaborate with one another; therefore, Eccleston suggested that collaboration needed to be structured, mindful, and purposeful. One must understand the need to meet as a team and collaborate and the administrators must support that need by providing common planning time in the schedule.

Perspectives of students on co-teaching. Klingner, Vaughn, Hughes, Schumm, and Elbaum (1998) discussed which instructional models students with educational disabilities prefer. The qualitative study consisted of individual interviews with 32 students. Out of the 32 students, 16 were students with learning disabilities, and 16 were general education students. Out of the total population of students interviewed, four students were in the fourth grade, 14 students were in fifth grade, and 14 were in sixth grade. All of the students in the study had spent "at least one academic year each in classroom participating in pull-out and inclusion special education service delivery models" (Klingner et al., 1998, p. 149).

The Klingner et al. (1998) study was a purposeful sample because students were selected only if they were in the setting within the previous 2 years of the study. The instrument that was used was the Students Views of Inclusion Interview, which was created by the researchers. The interview consisted of 12 questions designed to reveal student perceptions of the role their teachers played in their classrooms. The results showed that all students, whether learning disabled (LD) or non-LD, liked having the support of two teachers in the room.

"Overall, the students in this study considered the pull-out model to be preferable to inclusion, although the students with LD were closer to an even split on this issue than the non-LD students" (Klingner et al., 1998, p. 155). The students preferred the pull-out method because they were given individualized support in a smaller setting, while still participating in the larger class setting. The students “further reported some confusion about the role of the Special Education teacher” (p. 156) because they had difficulty defining the role of that educator. The researchers further noted that the students “consistently said they like working together and helping each other. The LD and non-LD considered other students to be resources” (Klingner et al., 1998, p. 156).

In 1999, Gerber and Popp completed a study in which they interviewed students, who were both classified and non-classified, as well as their families to get their perspectives on the models. Students and families volunteered to participate in the subsequent focus groups regarding perceptions. The results of the study yielded that the students both with and without supports enjoyed the class with the co-teachers.

The participants in the study included “four elementary, four middle and two senior high schools that had had collaborative teaching for at least 2 years” (p. 289). These schools were all part of the Metropolitan Educational Research Consortium located in Virginia. The majority of the students in the study (85%) were classified as students with LD. The co-teaching models did differ in the buildings. In the elementary school, co-teaching was used for all subjects. In the secondary level, co-teaching was only used in math, science, social studies, and English.

Gerber and Popp (1999) conducted structured interviews with staff, faculty, and students to gain their viewpoint regarding co-teaching. They further reported that the parents of both groups of students (students with and without disabilities) also expressed support for this model. The parents reported that they appreciated that the students were able to benefit from the expertise of both educators.

Sears et al. (2014) completed a study on co-teaching from the perspectives of both the co-teachers as well as the students with disabilities. This was a qualitative case study. The researchers used direct observation as well as surveys to learn more about the roles and perceptions of those involved in the models. The data revealed that the teachers mainly agreed that they worked well as a team.

There was a discrepancy when it came to which educator led the instruction (Sears et al., 2014). The general education teacher did not identify the special education teacher as running the instruction, but the special education teacher did identify themselves as leading instruction. This disconnect highlights the way the teachers in teams understand and view their roles within their co-teaching model. Students who were surveyed regarding the instructional models identified that they did feel that having two instructors was helpful and that both teachers split instruction to support students in the classroom.

Pham and Murray (2015) completed a study analyzing social relationships among adolescents with disabilities. The study included 228 special education high school students. The data revealed that the students reported that they had a positive life satisfaction. That means that the students felt supported by the adults and peers that worked with them daily. The study also revealed that there was a decrease in problem behaviors, illustrating that students in the co-teaching and self-contained classrooms had fewer problem behaviors than their general education counterparts. Importantly, the study revealed that students who were educated in a variety of inclusionary and self-contained classroom environments did not feel stigmatized as special education students any more than their general education peers, and they reported, overall, that they were happy with their educational programs.

Meta-Analysis and Meta-Synthesis

Several researchers have engaged in meta-analyses and meta-syntheses to identify the trends in data on co-teaching. The section below identifies and highlights such studies.

Although co-teaching has been a way to integrate and educate students with disabilities, along with their general educational peers, much of the data collected has come from qualitative studies focused on the perceptions of staff and students involved in the pairings. In 2001, Murawski and Swanson completed a meta-analysis. They analyzed all the studies that had been published prior to 2001. The purpose of this meta-analysis was to determine the amount and outcomes of studies conducted on, and related to, co-teaching. “Of the 89 articles reviewed on co-teaching, only six were quantitative and met the criteria for selection as set by the researchers in this meta-analysis” (Murawski & Swanson, 2001, p. 264).

Murawski and Swanson’s (2001) study illustrates that there has been very little quantitative analysis of co-teaching. The overwhelming majority of the research has utilized qualitative measures that focus on the attitudes and perceptions of teachers regarding co-teaching instructional methods.

Meta-analyses and meta-syntheses also have been completed on co-teaching from the qualitative perspective. These syntheses reviewed the breadth and depth of literature on co-teaching, and they revealed that most studies focused on the perspectives of the teachers involved in the integrated co-teaching setting.

For selection in the meta-analysis as well as the meta-synthesis Carlberg and Kavale (1980), Murawski & Swanson (2001), and Scruggs, Mastropieri, and McDuffie (2007), each author set criteria that the selected articles needed to fit into to be considered for the study. The use of online databases, as well as library files, allowed the authors to identify articles that met the prescribed criteria. After reading the articles, each team of researchers excluded those that did not meet the criteria.

In the 860 studies that were identified for possible inclusion based on the criteria, only 50 studies could be included in the meta-analysis study. This analysis revealed that there was no major difference in test results based on placement in either a special class, which included smaller student-to-teacher ratio, or in an integrated co-teaching setting. The differences were noted in terms of student perceptions regarding the instructional model in which they were placed. "The methodology of meta-analysis appears to have brought more clarity to the literature by extrapolating the untapped knowledge in primary research studies" (Carlberg & Kavale, 1980, p. 305). The researchers stated that the findings for their study were inconclusive because they did not support that placement in either instructional model, co-teaching or general education, produces better outcomes for students.

Scruggs et al. (2007) completed a quantitative meta-synthesis. "Previous reviews of co-teaching have summarized accumulated literature and identified important variables" (Scruggs et al., 2007, p. 393). "Based on these previous reviews (of literature)," Scruggs et al. "concluded that available efficacy data are generally positive, but limited" (p. 394). The meta-synthesis focused on the body of work regarding co-teaching, and it was "an attempt to integrate systematically a large body of related research literature" (p. 394). The meta-synthesis identified that most co-teaching that is occurring in schools uses the co-teaching pairing of one-teach, one-drift model. This model was previously identified by Bauwens, Hourcade, and Friend. (1989). This meta-synthesis focused on the teachers' perceptions regarding the roles and responsibilities within this pairing. It raised concerns, such as sharing responsibilities within the classroom as well as differentiating and educating all students in the classroom.

All of these analyses attempted to determine if co-teaching is a sound instructional model, yet all the researchers ended their studies with questions regarding the efficacy and effectiveness of co-teaching as an instructional model. In other words, do these models improve student test scores? As reported, the quantitative studies are too few to show any significant trends in terms of student test results, particularly at the high school level. One must conclude that, at this time, it is difficult to illustrate if co-teaching models are truly an effective form of instruction when measured against student outcomes.

Mathematics Instruction

Mathematics instruction is one that has an historical context. This section explains the evolution of mathematics instruction from a curriculum, merely for the affluent in the 1900s, to a common and challenging mathematical curriculum for all students by 2014.

There has been much research conducted on the effectiveness of mathematics instruction. In 2003, Royer published a book entitled *Mathematical Cognition*. In it he wrote about concerns regarding educating students in mathematics and some of the best practices used. Of interest, is his brief history of mathematics education in the 20th century.

In the beginning of the 20th century, particularly during the Progressive Era (1900-1920), algebra was considered a topic that should be taught "selectively" (Royer, 2003, p. 179) to certain groups of students. Many theorists during this time felt that algebra and geometry should be treated as an "intellectual luxury" (p. 179) and taught to students who really showed an aptitude in the subject.

Eventually, the National Council of Mathematics was created and began to collect data on mathematics in schools. During World War II, it "became something of a scandal that army recruits knew so little math that the army itself had to provide training in the arithmetic needed for bookkeeping and basic gunnery" (Royer, 2003, p. 181). The remediation that had to be completed for soldiers brought to light that not all students were learning math in the same way and with the same rigor.

In the 1950s, *new math* was created, and for the first time, it "actively involved mathematicians by having them contribute curriculum for k-12 education. This math focused on coherent and logical procedures to solving math problems" (Royer, 2003, p. 17). The goal of this new math was to make it easier for students to follow the curriculum and to improve math scores and enrollments in higher level classes, such as geometry, which had been on the decline.

This was also around the time that the USSR launched Sputnik. This brought into question the math and science programs of U.S. schools. This redesign of curriculum was used to show that the US was, indeed, competitive against its European counterparts. However, the new math referendum did not last, and again in the 1970s, the curriculum changed. This time, proponents advocated for a "back to basics" approach (Royer, 2003, p. 185), similar to what the progressives had advocated for earlier in the century.

The Open Education movement also gained traction during this time. Led by an English education model, it stressed that students should be able to self-select their learning. This began to cause a rift in many schools that were economically disadvantaged because students often did not have the support at home and other external motivators to reinforce what they were learning in school from their parents and/or guardians. This created an academic situation in which students were receiving unequal supports. Many students were not equipped to identify the areas of math instruction that they would have liked to or should have learned (Royer, 2003).

As a result, this approach to mathematics was quickly overturned in the 1980s, and was replaced by a push for national standards. The National Council for Mathematics teachers wrote a report entitled, “An Agenda for Action” in 1980 (Royer, 2003, p. 187). The report detailed that mathematical problem solving should include use of technology including calculators for all students to succeed and move forward with higher level mathematics.

The late 1990s brought the creation of math standards by the National Council of Mathematic Teachers. These standards included national benchmarks for students to achieve. Again, the strategies were based on the constructivist approach in which students should be able to develop their own math skills in whatever way was meaningful to them. By constructing their own knowledge, students were able to continuously improve by building on what they had learned previously (Royer, 2003).

In 1999, the federal government published a document identifying the 10 best mathematical programs. This was rather new to many states and local schools because they were often the ones making the curriculum decisions for their schools. This input from the federal government created a climate for intervention and input regarding local decisions for curriculum (Royer, 2003).

In 2014, a new curriculum, entitled Common Core, was brought to the states by the “governors and state commissioners of education from 48 states . . . and through their membership in the National Governors Association Center for Best Practices (NGA Center) and the Council of Chief State School Officers (CCSSO)” (Common Core State Standards Initiative, 2017, para. 1). This initiative by the governors and state leaders began in 2009 to ensure consistent mathematical instruction across the nation. This new curriculum created a national standard for mathematical skills. It included a significant literacy component as students were being asked to use critical thinking and reading skills to solve math problems (Engage NY, 2014).

One study that looked at the longitudinal effects of mathematical instruction was conducted using data provided by the Early Childhood Longitudinal Study, Kindergarten Class (ECLS-K), which is another “national longitudinal study that focused on children’s early school experiences in U.S. public and private schools through grade 5” (Judge & Watson, 2011, p. 149). The results of the study indicated that the achievement gap in math for students with disabilities widened with the passage of time.

Researchers used longitudinal achievement data to examine the pattern of math achievement. Data was collected from learning disabled students over a 6-year period beginning at the start of kindergarten, followed by results taken at the end of kindergarten, first grade, third grade, and fifth grade. The data indicated that students with disabilities scored below the 25th percentile in math throughout the 6-year time frame. Clearly, students with disabilities, over time, were not making gains in mathematics.

Mathematics continues to be a widely discussed topic in education both domestically and internationally. In 2005, Ayhan Kursat Erbas focused his study on predicting the performance of students in ninth-grade algebra based on set criteria. There were 217 students in the sample. The study included two public schools, one private and one vocational-technical school. The variables that were used included the student's prior year of mathematics performance, gender, and grade level. The researcher developed his own instrument that he validated prior to using it in his study. The data was analyzed quantitatively using a multiple-regression analysis.

The data showed that discrepancies in mathematics outcomes did not have much to do with student performance, rather it was correlated to the school that the students attended. Erbas (2005) further found that gender is not necessarily a predictor of algebra outcomes because females did not score as poorly as their male counterparts. The researcher found that the most significant correlate to student success in mathematics was enrollment in private schools. One could conclude that because these students typically have parents who are more affluent and have been college educated themselves, they develop a greater facility with math.

Witzel (2005) completed a study on the implementation of a hands-on algebraic approach for students with math difficulties in inclusive settings. The study included six general education teachers and 358 students from four middle schools. Four of the teachers individually taught eight mathematics classes for seventh graders, and two teachers taught four math classes for seventh graders. Each teacher taught one of their classes using the Concrete-Representational-Abstract (CRA) mathematical approach. This approach allowed for more hands-on learning and allowed students to learn algebraic skills through structured and scripted lessons. The results showed that the students who were provided this multi-sensory, hands-on approach performed better on the assessment at the end of the treatment than students who received the traditional algebraic instruction. The researcher did note, though, that the study focused on two different grades of students that could have impacted the study (Witzel, 2005).

In 2008, Michael S. Mathews and Jennie L. Farmer, published a study entitled *Factors Affecting the Algebra I Achievement of Academically Talented Learners*. This study looked at the outcomes of students who were *mathematically advanced*. Data was collected from seventh-grade students in North Carolina who were participating in advanced mathematics. There were set criteria to make one eligible for this testing. For example, a student had to test in the 95th percentile to be eligible. The second piece of data was that the end-of-the-year test scores for Algebra I in North Carolina.

The researchers used a variety of variables, such as parent education as well as participation in extracurricular activities, to determine if a “gifted status” was the primary reason for academic success in algebra. Their findings indicate that one of the major predictors of mathematical success is how much time a student spends on homework. This shows that although one can be naturally talented in mathematics, the amount of work that a student engages in after class and at home can be a strong predictor of success.

Social Constructivism

The concept that a student can achieve more when placed in a classroom with more capable peers and adults, has its roots in social constructivism. This theory is used to support the reasoning behind co-teaching.

There are many theories that describe how people learn in group or social settings. One of the major theories that describes the way people act and interact in group situations is by Lev Vygotsky (1978) and is entitled the social constructivist theory. Constructivism is a theory that attempts to explain the way people learn or develop. Social constructivism can be described as socialization, a process of acquisition of skills, knowledge, and dispositions that enables the individual to participate in his or her group or society. This socialization process consists of reciprocal interactions and joint construction of meaning by the individual and others in the social context (Sivan, 1986). Social constructivism looks at the interactions of students as they engage with their peers and adults to help them gain meaning and understanding.

A fundamental tenet of constructivism is that learners play an active role in their own development. In fact, Vygotsky (1978) suggested that learning precedes development, noting that it is only after children can observe and approximate a new skill and practice it with the help of more capable peers, that they eventually incorporate it into their own cognitive constructs (Mallory & New, 1994).

The main idea in this theory is that by placing students in social environments, where they can have appropriate peer and adult role models, helps them achieve success. Students and people learn best when they are able to *construct* or build their own knowledge. The social aspect of working and learning from a variety of people helps students to make their own connections and gain a better understanding of the larger concept.

For students to best learn, Vygotsky (1978) described a zone of proximal development (ZPD). The term "zone of proximal development" was defined by Vygotsky as "the distance between the actual development level as determined by independent problem solving and the level of potential development as determined through problem solving under adult guidance or in collaboration with more capable peers" (Vygotsky, 1978, p. 86). Another way to describe this theory is the "distance between what a learner can do alone, and his or her potential ability when guided by adult or more capable peers" (Purzer, 2011, p. 657). This means that placing students in an environment where they are provided with supports and asked to complete work that may be at more rigorous levels can be achieved due to ZPD. Working with the supports provided by adults or appropriate peer models help them achieve success.

Vygotsky (1978) further stated that an essential feature of learning is that it creates the ZPD; that is, learning awakens a variety of internal developmental processes that are able to operate only when the child is interacting with people in his environment and in cooperation with his peers. "Once these processes are internalized, they become part of the child's independent developmental achievement" (p. 90).

Vygotsky (1978) utilized ZPD to explain why students need to be placed in educational settings with adults and capable peers. By having appropriate academic models, students are able to learn more from the modeling that is provided by staff and students who may understand the concepts better than the students do. ZPD allows the students the opportunity to work with supports until they can internalize the knowledge for themselves.

ZPD allows students to have access to the information and content being taught, while benefitting from the socialization and support provided by another teacher or peer. The socialization and conversation that occur when learning the content allows students to retain the information presented and construct their own meanings through peer and staff interaction.

"According to Vyogtsky (1978), the construction of knowledge is a social process, and group learning experiences expand students' abilities beyond what they can individually do" (Purzer, 2011, p. 657). This theory helps to support the notion that whole-group instruction with students of a variety of levels, commonly referred to as a heterogeneous grouping, is beneficial for all. Students can meet, interact, and support one another as they learn classroom content.

The idea of constructivism, or building and creating your own knowledge, also has its roots in the works of Piaget (1954). "One of Piaget's (1954) most important discoveries was to demonstrate how a child progressively constructs the idea of permanent objects that continue to exist outside of his or her experience" (Elkind, 2005, p. 328). Although Piaget (1964) and Vygotsky's (1978) theories became widely known and respected around the same time in history, the distinct difference between the theories is that Piaget spoke about the four stages one must go through when learning.

Jean Piaget (1964) wrote about the developmental stages that students encounter when they are learning new information. "Cognitive development is the reorganization of mental structures, which occurs when a person spontaneously acts on the environment (transforms it), experiences disequilibrium, and assimilates and accommodates events" (Wadsworth, 1978, p. 29). He discussed that there are four developmental stage every student must go through to help them grow.

"The Piagetian view is that development determines to a large extent how learning can process" (Wadsworth, 1978, p. 30). This means that there are four stages Piaget stated that all individuals must go through in terms of development. At each stage, one reaches a new milestone. Linking it to Vygotsky (1978), one can assume that when placed in settings with typical peers, students with disabilities would be provided with models of typical development that they could mirror.

According to Piaget (1964), the four stages of development are:

1. Sensorimotor
2. Preoperational
3. Concrete
4. Formal

These four stages describe the milestones that children reach. In *sensorimotor*, the important milestone is the interaction of the child with his or her senses and the environment (Piaget, 1964, p. 20). The second stage *preoperational* relates to that during this stage, the intuitive mode of thought prevails. It is often characterized by free association, fantasy and unique illogical meaning" (p. 21). The *concrete* stage has "two main milestones for the child to learn fundamental skills in reading, writing, and calculating arithmetic problems as well as be able to accept his/her own aptitude for school" (p. 21). The final stage also known as *formal* is one in which the student is capable of considering the ideas of others and communicating with them, since he/she is well into the socialized speech phase of language development" (Piaget, 1964, p. 21).

Chapter Summary

This chapter provides the reader with the historical context and research related to co-teaching and mathematical practices. Much of the research currently available is qualitative in nature and focuses on the perceptions of students and faculty in the instructional settings. The quantitative studies that do exist are small in number and speak to the lack of data, particularly longitudinal data on student growth. There is a need for quantitative analysis at the high school level.

Chapter 3 focuses on the research design of this study and how the research questions were answered to determine the effectiveness of the co-teaching models used in a suburban/urban high school. A quantitative analysis was used to look at student test outcomes over a 2-year period to determine if the local models of co-teaching produce better student outcomes.

Chapter 3: Research Design Methodology

Introduction

"Despite the proliferation of co-teaching (Walther-Thomas, Bryant, & Land, 1996, p. 1), research into its effectiveness is extremely limited, especially at the secondary level" (Magiera & Zigmond, 2005, p. 3). This lack of quantitative data regarding the effectiveness of co-teaching supports that there is "currently, a need for more empirical research in the area of co-teaching" (Dieker & Murawski, 2003, p. 4).

The purpose of this research was to investigate the effectiveness of three local instructional models, across four sections, on student outcomes in ninth-grade Algebra I. The researcher was interested in learning if any of the four local co-teaching models, interventionist, specialist, or departmentalized, produced different student outcomes in Algebra I. At the time of this study, the three instructional models under study were being used in a local high school in an urban area in Westchester County, NY.

The interventionist model is an instructional model in which an individual who is New York State certified in special education supports classified students in all their academic classes (English, math, social studies, and science) as well as their academic support class. The special education teacher is not mathematics certified. She co-teaches in a classroom with a general education teacher who is certified in the content area being taught. The special education teacher is in all the academic classes with the students and teaches a separate self-contained academic support class. It is of interest to the researcher to see if a similar grouping of students performs differently in either instructional model.

The specialist model is an instructional model in which an individual who is New York State certified in mathematics and special education, co-teaches with an individual who is New York State certified in mathematics. The special education teacher only teaches in the academic class for which he or she is certified in (math). There are four separate pairings of co-teachers for this model. One of the four special education teachers provides a self-contained academic support class for the students assigned to this co-teaching model.

The final model is the departmentalized model. This is the instructional model in which a certified special education and biology teacher 7-12 co-teaches Algebra I with a certified general education math teacher grades 7-12.

Research Context

The local district that was used for the study is an urban high school located in New York State. Table 3.1 highlights the demographic breakdown of the student population over the 2 years of the study.

Table 3.1

Student Demographics School Years 2014-2015 and 2015-2016

	School Year 2014-2015	School Year 2015-2016
Total Population	3,401	3,330
Male	1768 (52%)	1,706 (51%)
Female	1633 (48%)	1,629 (49%)
Hispanic	1,445 (42%)	1,478 (44%)
White	929 (27%)	870 (26%)
Black/African American	893 (26%)	843 (25%)
Multi-Racial/American Indian	16 (0%)	136 (4%)
Ninth-Grade Cohort	983	959
Economically Disadvantaged	1,549 (46%)	1,820 (55%)
English Language Learners	185 (5%)	199 (6%)
Students with Disabilities	474 (14%)	513 (15%)

Note. Adapted from NRCSD NYS Report Card 2015.

The most recent data for the school year 2014-2015 identified that there were 179 full-time faculty members that taught in this school. All the teachers in the high school had valid teacher credentials. Only 2% of the teaching staff had less than 2 years of teaching experience, and 58% of the staff had master's degrees and an additional 30 hours of study or a doctorate. This is important to note in the study, because the co-teaching teams comprised educators with several years of professional experience as well as educators who were all certified in their content areas. The special educators were able to provide "highly qualified instruction," as defined by law, because they were certified in special education and in the content area in which they were providing instruction. This staff data was very similar to the previous years, given that there is a 2% turnover rate of professional staff. As a result, the school had remained stable in its number of instructional staff.

The instructional models that were utilized for the academic year 2015-2016 are listed below:

Table 3.2

Instructional Models Used for Academic Year 2015-2016

Model	General Education Certification	Special Education Certification
Specialist A Year 2	Math 7-12	Math 7-12/Special Education 7-12
Specialist B Year 2	Math 7-12	Math 7-12/Special Education 7-12
Specialist C Year 2	Math 7-12	Math 7-12/Special Education 7-12
Interventionist Year 2	Math 7-12	Special Education Permanent

Research Participants

The target population for the study were ninth graders who had participated in one of the three models over the past 2 school years, 2014-2015 and 2015-2016. In the year 2014-2015 there was one departmentalized model, one interventionist model, and two specialist models. In the 2015-2016 school year, there was one interventionist model and three specialist instructional models. The total number of students who participated in each co-teaching models in Academic Year 2014-2015 is show in Figure 3.1.

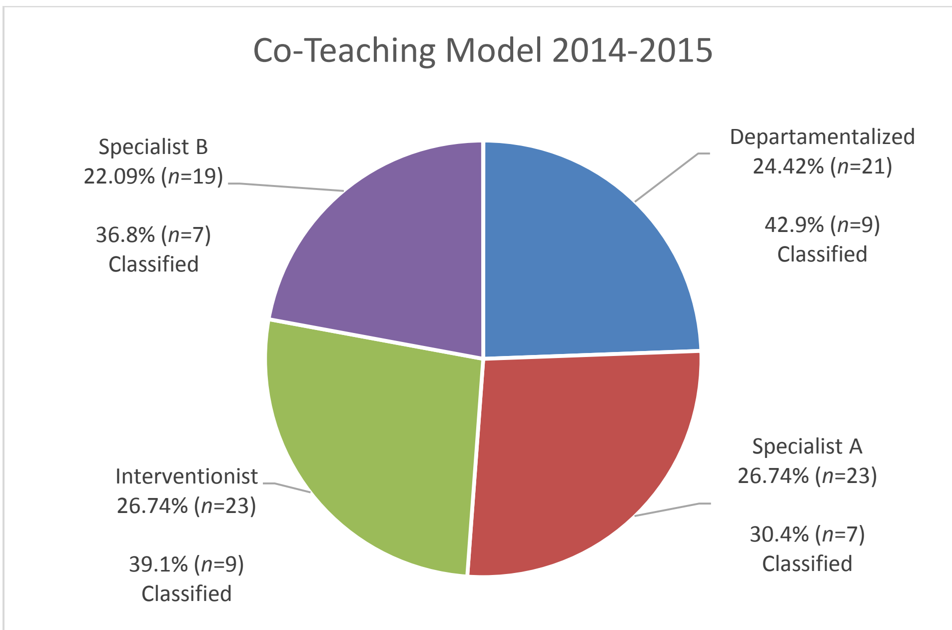

Figure 3.1. Co-teaching model for 2014-2015.

The total number of students who participated in each co-teaching model in Academic Year 2015-2016 is shown in Figure 3.2. It should be noted that during this academic year, the departmentalized model was removed and another section of the specialist model was added.

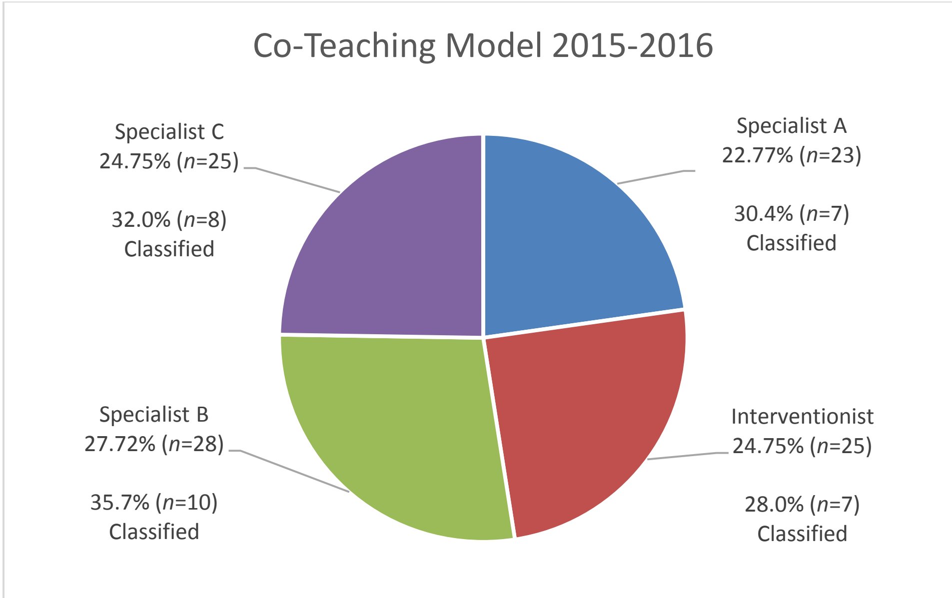

Figure 3.2. Co-teaching model for 2015-2016.

The yearly total for all students in the study was187. Of that number, 123 were not classified and 64 were classified with an educational disability. This is considered a purposeful sample because there is "intentional selection as to the participants in this study" (Johnson, 2013, p. 167).

Students who were be in the middle school and taking Algebra I as an accelerated course, as well as upperclassman who were repeating this course, were not included in this sample. The study aimed to look at the outcomes of students in one of these models and who took this course for the first time in ninth grade.

Instruments Used in Data Collection

The researcher conducted a quantitative quasi-experimental study using archival data. The data consisted of pretest and posttest results that might have determined the effectiveness of the two instructional models, interventionist and specialist. The test results were analyzed for each school year for 2 years, 2014-2015 and 2015-2016, to determine growth and trends regarding student performance in the Algebra I classes.

The retrospective data was retrieved from the tests that students took at both the beginning and end of each school year. The locally created Student Learning Outcomes (SLOs) were used as the pre-assessment, and the NYS Algebra I Regents exams were the post assessment. The pre-assessment is a locally created exam. It is created by the math teachers in the district. This method allows for the assessment to have *face and content validity* because it had been created by a number of experts in the field of mathematics instruction, utilizing New York State algebra questions. This helps to ensure that all the Algebra I standards were being addressed in the SLO and that the questions reflected the content that students would be exposed to during the school year. This SLO exam was administered to all students within the district who were participating in the Algebra I course that was being offered.

The students were assessed at the end of the year using the NYS algebra Regents exam. This is an exam that is given to all students enrolled in Algebra I across New York State. This approach to data collection helped the researcher determine if either the interventionist or the specialist instructional model in ninth-grade Algebra I was having a more significant positive impact on students' outcomes. This is important because one of the benchmarks that NYS has put into place for graduation with a NYS Regents diploma is to have all students, including students with disabilities, pass the Regents exams—one of which must be a math exam. Most high schools across NYS use Algebra I as the exam for all students to pass, because research has shown that basic Algebra I is a precursor to success in college.

The instructional models served as the independent variable (Laerd Statistics, 2016). A multivariate analysis of variance (MANOVA), as well as a one-way analysis of variance (ANOVA), was used to determine the data between and within each group. Both the ANOVA and MANOVA were used for the study "as the data set includes more than one independent variable" (Mertens & Wilson, 2012, p. 458). The researcher analyzed the data to identify trends among each class setting as well as to illustrate if there was any student growth across the three models and four sections.

The researcher used the Statistical Program for Social Sciences (SPSS) to analyze the data. The researcher also used both the ANOVA and MANOVA to determine whether there "were any significant differences between the means of three or more independent (unrelated) groups" (Laerd Statistics, 2016, para.1) as well as the Bonferroni post-hoc test (Statistics How To, 2017).

Procedures for Data Analysis

The researcher gathered data from the participating school district, which was provided with three different data sets, including student identification number, pretest score, and posttest score. The researcher was also provided with information as to whether a student was classified with an educational disability, but the researcher did not know the specific educational disability. The classes ranged in total size from 19-28 students; 7-10 students in each class setting were classified as a student with an educational disability. For the purposes of this research, the groups were defined as the interventionist, specialist, and departmentalized instructional models.

The SLO was administered at the beginning of the year. The posttest at the end of the year was the NYS Algebra I exam. The data was analyzed using the SPSS and both an ANOVA as well as a MANOVA. To identify the mean growth score trends among each class setting, the researcher used the ANOVA as well as the Bonferroni post-hoc test (Statistics How To, 2017) to identify which model or statistical significance was noted. A multivariate MANOVA test was used to note the growth from the pretest and posttest scores. The MANOVA "is used to determine whether there are any significant differences between the means of three or more independent (unrelated) groups" (Laerd Statistics, 2016, para. 1). The MANOVA allowed the researcher to look across the three models to see if the trends that emerged illustrated student growth across all three models for any of the student results that were studied.

The SPSS-generated tables illustrated if there were noted gains in student achievement in any of the models over any of the school years. A statistically significant relationship between variables is noted if it had a value of 0.05 or below. The value of 0.05 means that a set of data is significant, and it demonstrates that a student did make noted gains in one of the models being studied.

The study design was a quasi-experimental design. Mertens and Wilson (2012) described this model as one that is used "when random assignment to conditions is not possible" (p. 320). Because this was an archival analysis with a quasi-experimental design, the researcher had no control over the grouping of students who participated in any of the instructional models that were being studied.

In order to make sure that the data was valid and reliable, the researcher was able to illustrate construct validity. Mertens and Wilson (2012) asked "to what degree does all accumulated evidence support the intended interpretation of scores for the proposed purpose?" (p. 363). As this is a study that looked at student outcomes using pretest and posttest scores, the researcher constructed validity within the data because that was the major data that was analyzed.

Descriptive data was used to look at differences in gender and classification status of students. This is because, for the purposes of this study, two selections for gender, either male or female, existed. To analyze the test scores, the researcher used interval data because the study included a range of scores (Mertens & Wilson, 2013, p. 460). Bivariate tests (Table 4.2) were used to examine if there were any significant differences in gender or classification status. Table 4.3 describes the means of the study.

As this was a retrospective analysis, the researcher worked with the district that was being studied to obtain the archival data. The use of both an ANOVA as well as a MANOVA allowed the researcher to look across the three models (and four sections) to see how the subgroups performed. It is often suggested that in quantitative research, your grouping, otherwise known as your *n* be no smaller than 30. If a class does have less than 30 students, it could cause a type 1 error and threaten the validity of the data. Parametric test assumptions were also examined including a normal distribution of pretest and posttest scores as well as undue influence of outliers (very high and very low scores), included in the test of normal distribution, and it revealed no significant problems.

There were other threats that the researcher needed to be aware of. Several factors, such as history and maturation of the subjects could have affected the outcomes of the data (Mertens & Wilson, 2012). Because, the researcher had no control over the results and must report the findings, this is an archival analysis, and the data and threats were acknowledged by the researcher.

Summary

The study utilized archival data for 2 years of Algebra I math performance for ninth graders. A quasi-experimental and quantitative methodology was used to determine if any of the three local co-teaching instructional models, comprising four sections were more effective in student outcomes. The study was considered quasi-experimental because it was retrospective, and the researcher was not able to manipulate the independent variables. The independent variables were the instructional models, and the dependent variable was the student outcomes on the NYS Regents exam results. Performing a quantitative study allowed the researcher to identify if any of the models are achieving better outcomes for students with disabilities, as well as non-classified student

Chapter 4: Results

The purpose of this chapter is to report on the effectiveness of three local co-teaching instructional models, which span across four sections, in bringing about improved student outcomes in ninth-grade Algebra I. The researcher was interested in learning if any of the three local co-teaching models (interventionist, specialist, or departmentalized) spread across four sections, can produce significantly better or worse student outcomes in Algebra I. At the time of this writing, the instructional models under study were being used in a local high school in an urban area in Westchester County, NY.

The interventionist model is an instructional model in which an individual, who is New York State certified in special education, supports classified students in all their academic classes (English, mathematics, social studies, and science), as well as in their academic support class. The special education teacher in this study was not mathematics certified. She co-taught in a classroom with a general education teacher who was certified in the content area being taught. The special education teacher was present in all the academic classes with the students, and she teaches a separate self-contained academic support class.

The specialist model is an instructional model in which a teacher, who is New York State certified in mathematics and special education, co-teaches with a teacher who is New York State certified in mathematics. The special education teacher only teaches in the academic class in which he or she is certified (mathematics). There are two sections of the specialist model, making four separate pairings of co-teachers for this model. One of the four special-education teachers in this model provided a self-contained academic support class for the students assigned to this co-teaching model.

Finally, the departmentalized model is one in which a certified special education and biology teacher 7-12 co-teaches Algebra I with a certified general education mathematics teacher for Grades 7-12. The biology teacher further acted as the special education co-teacher in a science class with the same students in the Algebra 1 class. It is of interest to the researcher to see if similar groups of students experience different outcomes in Algebra I across the selected instructional models. Table 4.1 shows the individual co-teaching models identified by teacher certification for the Academic Year 2014-2015.

Table 4.1

Individual Co-Teaching Models Identified by Teacher Certification for Academic Year 2014-2015

Model	General Education Certification	Special Education Certification
Departmentalized Year 1	Math 7-12	Biology 7-12 & Special Education 7-12
Interventionist A Year	Math 7-12	Special Education Permanent
Specialist A Year 1	Math 7-12	Math 7-12/Special Education 7-12
Specialist A Year 1	Math 7-12	Math 7-12/Special Education 7-12

The total number of students who participated in each co-teaching model in the Academic Year 2014-2015 is shown in Figure 4.1.

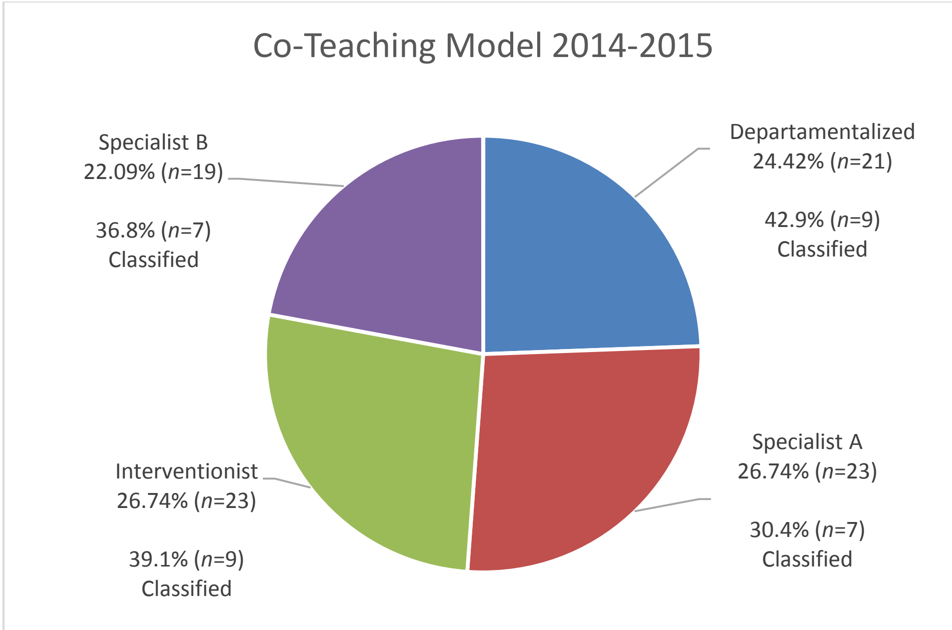

Figure 4.1. Total number of students who participated in each co-teaching model in Academic Year 2014-2015.

Table 4.2 shows the individual co-teaching models identified by teacher certification for the Academic Year 2015-2016.

Table 4.2

Individual Co-Teaching Models Identified by Teacher Certification for Academic Year 2015-2016

Model	General Education Certification	Special Education Certification
Specialist A Year 2	Math 7-12	Math 7-12/Special Education 7-12
Specialist B Year 2	Math 7-12	Math 7-12/Special Education 7-12
Specialist C Year 2	Math 7-12	Math 7-12/Special Education 7-12
Interventionalist Year 2	Math 7-12	Special Education Permanent

The total number of students who participated in each co-teaching model in the Academic Year 2015-2016 is shown in Figure 4.2. It should be noted that during this academic year, the departmentalized model was removed, and another section of the specialist model was added.

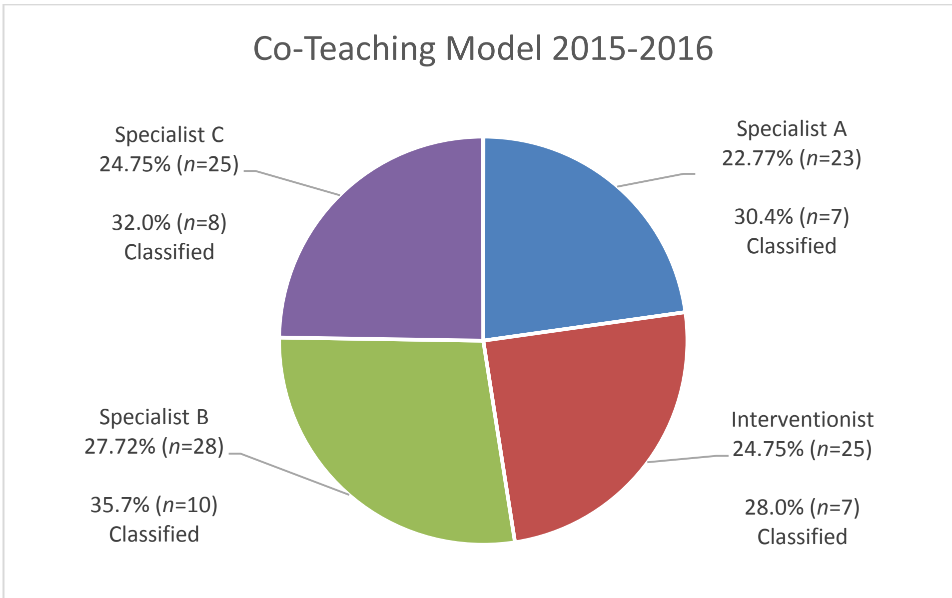

Figure 4.2. Total number of students who participated in each co-teaching model in Academic Year 2015-2016.

Research Questions

This research was guided by the research questions along with null and alternative hypotheses:

1. Is there a difference in student outcomes in Algebra I for non-classified students enrolled in the interventionist co-teaching, specialist co-teaching, or departmentalized instructional model?

(a) H1: Null Hypothesis 1: There is no difference in student outcomes in Algebra I for non-classified students enrolled in the interventionist co-teaching, specialist co-teaching, or departmentalized instructional model.

(b) H1: Alternative Hypothesis 1: There is a difference in student outcomes in Algebra I for non-classified students enrolled in the interventionist co-teaching, specialist co-teaching, or departmentalized instructional model.

2. Is there a difference in student outcomes in Algebra I for classified students enrolled in the interventionist co-teaching, specialist co-teaching, or departmentalized instructional model?

   (a) H2: Null Hypothesis 2: There is no difference in student outcomes in Algebra I for classified students enrolled in the interventionist co-teaching, specialist co-teaching, or departmentalized instructional model.

   (b) H2: Alternative Hypothesis: There is a difference in student outcomes in Algebra I for classified students enrolled in the interventionist co-teaching, specialist co-teaching, or departmentalized instructional model.

3. What is the average growth, if any, for students in ninth-grade Algebra I who are enrolled in the interventionist co-teaching, specialist co-teaching, or departmentalized co-teaching instructional model over a 1-year period.

Data Cleaning, Analysis, and Findings

Data were provided to the researcher from the selected district. The data were organized and screened by the researcher to protect participants from any identifying indicators. The data provided to the researcher were in three distinct data sets. The first data set that was provided to the researcher was the individual section identification numbers for each co-teaching section.

The next data set that was provided to the researcher had students' names, identification numbers, classification status, and pretest scores. The final set of data provided to the researcher had the students' names and posttest scores, otherwise referred to as the Algebra I Regents scores for the selected academic years. In order to determine in which instructional model the students were placed, the researcher completed a certification check on the teachers in each model. This data is available on the NYS website known as TEACH (NYSED, 2017), which provides, as a public record, the teaching credentials and certificates held by all certified teachers in New York State.

The researcher and the selected district attempted to obtain the statistics for the academic year 2013-2014, but the data for the models was unavailable because the records could not be located. The researcher cleaned and sorted the data by creating two master Excel spread sheets. The data were cleaned to include student numbers that were created by the researcher. The variables that were included on the spread sheet included student ID numbers (created by the researcher), gender, classification, pretest score, posttest score, as well as the model and academic year that they participated in. Of the student data that was reviewed 11 of the students were missing one of the variables for the study; therefore, their data sets were removed, which created a normal distribution.

After preparing the cleaned and sorted data, they were entered into the Statistical Program for Social Sciences (SPSS), which was used for statistical analysis. The data analysis plan was conducted in three phases. First, all study variables were presented using descriptive statistics, such as, means, standard deviation, and minimum/maximum values for continuous variables (interval/ratio level), and frequencies and percentages for categorical variables (nominal/ratio level). Bivariate testing was also conducted.

Initially, changes in the scores were computed by subtracting posttest scores from pretest scores. Then, possible covariate variables were considered by examining if year, gender, and/or student classification were significantly ($p < .05$) related to pretest/posttest change scores (via independent-sample *t*-tests).

Any covariate variables significantly related to pretest/posttest changes would be controlled for when determining the relationship between the independent variable (class type), otherwise referred to as the *instructional model*, and the dependent variable (posttest-pretest changes in Algebra 1 scores) within the final multivariate analysis model (repeated-measures MANOVA). The third phase of the data analysis plan used a multivariate, repeated-measures MANOVA to examine if the differences in posttests and pretests were at a statistically significant level by class type, while controlling for any significant covariate variables. All test assumptions related to parametric testing were examined, and they revealed no significant problems, including checks of normality (via the examination of posttest-pretest changes) and linearity. Given that there were six scores in the distribution that neither had a pretest nor posttest score, they were excluded from the analysis. This resulted in the assumption of no undue effects of outlier scores.

In terms of statistical power, the G*power software indicated that there was a small-sized effect ($f = .25$) between the means of the pretest to posttest algebra scores by the eight categories of class type, with the power set at .80 and the probability set at .05, which would require a sample size of 128 study participants. Thus, the sample of 187 study participants provided sufficient statistical power for the overall analysis, but it might have been slightly underpowered for the analysis when only the classified (*n* = 64) or non-classified groups (*n* = 123) were examined. Regarding missing data, the 11 study participants who were missing data were eliminated from the analysis. This is an acceptable solution to the missing data issue given that this number reflected approximately 5% (11/204 = 5.4%) of the original sample (Bakker & Witkins, 2014).

Descriptive Analysis

Table 4.3 presents a descriptive analysis of the categorical study variables. The data indicated that about one-third (*n* = 64; 34.2%) of the sample were classified students. Approximately half the sample was male versus female (*n* = 98; 52.4 vs. *n* = 89; 47.6%, respectively), as well as by study year 2014-2015 vs. 2015-2016 (*n* = 86; 46.0% vs. *n* =101; 54.0%).

Table 4.3

Descriptive Analysis of Categorical Study Variables (N = 187)

Variable	*N*	Percent (%)
Classified		
Yes	64	34.2
No	123	65.8
Gender		
Male	98	52.4
Female	89	47.6
Year		
Academic Year 2015-2015	86	46.0
Academic Year 2015-2016	101	54.0
Class Type (2014-2015)		
Departmentalized Year 1	21	11.2
Specialist A Year 1	23	12.3
Interventionist Year 1	23	12.3
Specialist B Year 1	19	10.2
Class Type (2015-2016)		
Specialist A Year 2	23	12.3
Interventionist Year 2	25	13.4
Specialist B Year 2	28	15.0
Specialist C Year 2	15	13.4

There were 86 students in the study for Academic Year 2014-2015 and 101 students in Academic Year 2015-2016. Regarding class type, also known as instructional models, all categories were rather evenly distributed with about 10-15% of the study participants within each class. The descriptive variables regarding classified, gender, academic year, and class type are listed in Table 4.3. Note that for the purposes of this study, *N* refers to the total sample, *n* refers to part of the total sample, and percent (%) refers to the percentage of the total number of students in the sample.

Bivariate Analysis

Table 4.4 presents a bivariate analysis of pretest to posttest changes in Algebra 1 scores by classification status, year, and gender. The data revealed that changes in algebra scores were not significantly related to student classification – $t(105.79) = 1.54$, $p = .13$; study year – $t(185) = 1.82$, $p = .07$; or gender – $t(185) = 1.38$, $p = .17$. Thus, none of these possible covariates needed to be controlled in the final multivariate repeated-measures MANOVA model that was examining the relationship between the independent and dependent variables. Table 4.4 table illustrates that neither classification status, gender, nor academic year provided statistically significant outcomes.

Table 4.4

Bivariate Analysis of Pretest to Posttest Changes in Algebra 1 Scores by Classification Status, Year, and Gender (N = 187)

Variable	*N*	*M (SD)*	*t/F(df)*	*p*
Classified			–1.54 (105.79)	.13
Yes	64	44.16 (14.78)		
No	123	47.44 (11.81)		
Gender			1.38 (185)	.17
Male	98	47.56 (13.19)		
Female	89	44.94 (12.63)		
Year			1.82 (185)	.07
Academic Year 2015-2015	86	44.73 (12.38)		
Academic Year 2015-2016	101	48.17 (13.44)		

Hypothesis 1. Is there a difference in student outcomes in Algebra I for non-classified students enrolled in the interventionist co-teaching, specialist co-teaching or departmentalized instructional model?

Null hypothesis 1. There is no difference in student outcomes in Algebra I for non-classified students enrolled in the interventionist co-teaching, specialist co-teaching, or departmentalized instructional model.

Alternative hypothesis 1: There is a difference in student outcomes in Algebra I for non-classified students enrolled in the interventionist co-teaching, specialist co-teaching, or departmentalized instructional model.

The data indicate that the alternative hypothesis is supported regarding hypothesis 1. Specifically, Table 4.5 presents a repeated-measures MANOVA analysis of the changes in Algebra 1 scores from the pretests to posttests, overall, as well as by class type for non-classified students. The analysis indicates that the overall change in mean scores from the pretest ($M = 19.29$, $SD = 11.89$) to the posttest ($M = 66.72$, $SD = 8.73$) was statistically significant, $F(1, 122) = 1984.36$, $p < .001$. Further analysis indicates that the changes in Algebra 1 scores did vary by class type at a statistically significant level, $F(7, 1115) = 6.96$, $p < .001$. Table 4.5 illustrates that when students' pretest and posttest scores were compared to one another, statistically significant growth for the non-classified students was noted. As shown in Table 4.5, the overall change from pretest to posttest scores was statistically significant, with a p value of .001. The change by class type or instructional model was also significant with a value of .001. Figure 4.3 is a plotted graph displaying these relationships.

Table 4.5

Repeated-Measures MANOVA of Changes in Study Pretest to Posttest Algebra 1 Scores for Non-Classified Students (n = 123)

Variable	*n*	Pretest *M (SD)*	Posttest *M (SD)*	*F(df)*	*p*
Overall Change	123	19.29 (11.89)	66.72 (8.73)	1984.36 (1, 122)	.001[1]
Change by Class Type				6.96 (7, 115)	.002[2]
Departmentalized Year 1	12	14.00 (6.82)	68.00 (12.46)		
Specialist A Year 1	16	34.13 (9.68)	73.87 (8.27)		
Interventionist Year 1	14	14.71 (7.54)	73.71 (7.32)		
Specialist B Year 1	12	25.17 (8.23)	70.17 (7.49)		
Specialist A Year 2	16	16.25 (8.75)	63.44 (6.57)		
Interventionist Year 2	18	14.44 (10.43)	60.50 (6.28		
Specialist B Year 2	18	26.67 (11.28)	66.00 (6.28)		
Specialist C Year 2	17	8.82 (6.26)	61.35 (5.48)		

Note. [1]PES effect size = .94 (large effect size); [2]PES effect size = 30 (medium effect size)

Table 4.6 presents a one-way ANOVA of the pretest to posttest Algebra 1 change scores for non-classified students by class type. The Bonferroni post-hoc analysis indicated that the *Departmentalized, Year 1* group had significantly higher mean change scores compared to the *Specialist, A Year 1* group and the Specialist B Year 2 group. Furthermore, the post-hoc analysis indicated that the *Interventionist, Year 1* group had significantly higher mean change scores compared to the *Specialist A, Year 1* group, the *Specialist B, Year 1* group, the *Interventionist, Year 2* group, and the *Specialist B, Year 2* group. Lastly, the post-hoc analysis indicated that the *Specialist C, Year 2* group had significantly higher mean change scores compared to the *Specialist A, Year 1* group and the *Specialist B, Year 2* group.

Table 4.6

One-Way ANOVA of Changes in Study Pretest to Posttest Algebra 1 Scores for Non-Classified Students by Class Type (N = 123)

Variable	*n*	Pre/Posttest Change *M (SD)*	*F(df)*	*p*
Change by Class Type			6.96 (7, 115)	.001[1]
Departmentalized Year 1	12	54.00 (9.36)		
Specialist A Year 1	16	39.75 (12.04)		
Interventionist Year 1	14	59.00 (10.15)		
Specialist B Year 1	12	45.00 (9.02)		
Specialist A Year 2	16	47.19 (8.90)		
Interventionist Year 2	18	46.06 (9.73)		
Specialist B Year 2	18	38.33 (12.54)		
Specialist C Year 2	17	52.53 (8.33)		

Note. [1]Bonferroni post-hoc analysis indicated that the Departmentalized Year 1 group had significantly higher mean change scores compared to the specialist A Year 1 group and the Specialist B Year 2 group.

Lastly, the post-hoc analysis indicated that the *Specialist C, Year 2* group had significantly higher mean change scores compared to the *Specialist A, Year 1* group and the *Specialist B, Year 2* group. The overall mean change for all non-classified students reveals that the *Departmentalized, Year 1* model as well as *Interventionist, Year 1* model had the highest mean changes. For academic year 2, *Specialist A, Year 2* as well as *Specialist C, Year 2* also illustrated the most statistically significant mean changes. The overall change for all models was statistically significant with a *p* value of .001. This suggests that the overall mean changes for all models was statistically significant.

Figure 4.3 identifies the scores of each section of classes for non-classified students based on pretests as well as the final scores based on the posttests. It should be noted, that all models achieved growth, however, the *Departmentalized, Year 1* and

Interventionist, Year 1 had the largest noted growth along with *Specialist A, Year 2*, and *Specialist C, Year 2*.

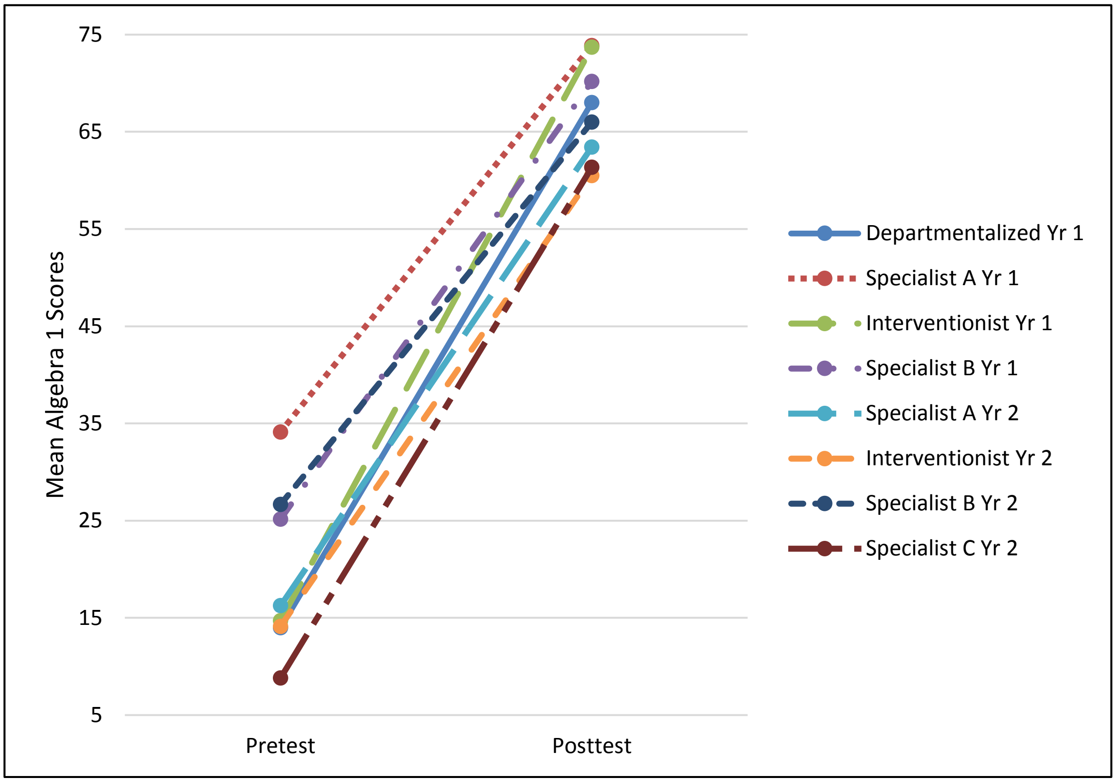

Figure 4.3. Graph of changes in the study pretest to posttest Algebra 1 scores by class type for non-classified students (n=123).

Hypothesis 2. Is there a difference in student outcomes in Algebra I for classified students enrolled in the interventionist co-teaching, specialist co-teaching, or departmentalized instructional model?

Null hypothesis 2. There is no difference in student outcomes in Algebra I for classified students enrolled in the interventionist co-teaching, specialist co-teaching, or departmentalized instructional model.

Alternative hypothesis. There is a difference in student outcomes in Algebra I for classified students enrolled in the interventionist co-teaching, specialist co-teaching, or departmentalized instructional model.

The data indicated that the alternative hypothesis is supported regarding hypothesis 2. Specifically, Table 4.7 presents a repeated measures MANOVA analysis of the changes in Algebra 1 scores from the pretest to posttest, overall, as well as by class type for classified students. The analysis indicated that the overall change in mean scores from the pretest (M = 15.69, SD = 11.18) to the posttest (M = 59.84, SD = 9.75) was statistically significant, F(1, 63) = 571.23, p <. 001. Further analysis indicates that changes in Algebra 1 scores did vary by class type at a statistically significant level, F(7, 56) = 3.59, p < .01. Figure 4.2 displays the plotted graph of these relationships.

Table 4.7 illustrates that students who are classified with educational disabilities experience higher mean changes in the *Departmentalized Year 1* model as well as *Specialist B Year 1*. In the academic year 2015-2016, the largest mean changes for classified students was noted within the *Interventionist Year* 2 model and the *Specialist C Year 2* model.

Table 4.7

Repeated Measures MANOVA of Changes in Study Pretest to Posttest Algebra 1 Scores for Classified Students (N = 64)

Variable	*N*	Pretest *M (SD)*	Posttest *M (SD)*	*F(df)*	*p*
Overall Change	64	15.69 (11.18)	59.84 (9.75)	571.23 (1, 63	.0011
Change by Class Type				3.59 (7, 56)	.0032
Departmentalized Year 1	9	8.89 (9.09)	62.11 (8.05)		
Specialist A Year 1	7	29.14 (8.34)	64.00 (8.78)		
Interventionist Year 1	9	9.78 (4.47)	65.33 (11.98)		
Specialist B Year 1	7	21.00 (10.79)	59.57 (8.79)		
Specialist A Year 2	7	15.43 (10.41)	60.29 (10.84)		
Interventionist Year 2	7	8.86 (6.69)	60.00 (7.59)		
Specialist B Year 2	10	21.80 (14.20)	55.60 (9.03)		
Specialist C Year 2	8	12.13 (5.41)	52.60 (8.94)		

Note. [1]PES effect size = .90 (large effect size); [2]PES effect size = .31 (medium effect size)

Figure 4.4 shows the growth in the models from pretest to posttest for classified students. Growth was noted in all models; however, larger growth was noted in both the *Departmentalized Year 1* model as well as the *Specialist B Year 1* model. In the academic

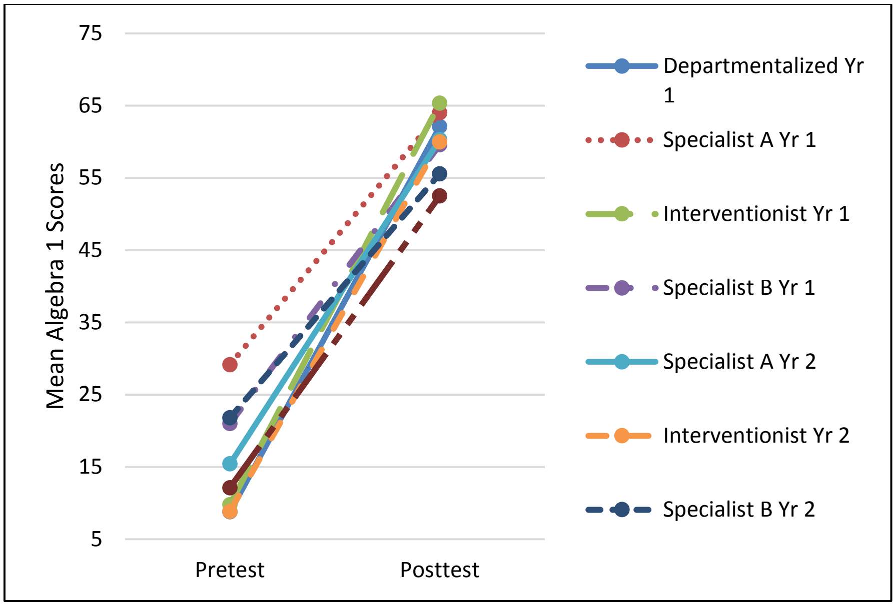

Figure 4.4. Graph of changes in study pretest to posttest Algebra 1 scores by class type for classified students (n = 64).

year 2015-2016, the largest mean changes for classified students was noted within the *Interventionist Year 2* model and the *Specialist C Year 2* model.

Table 4.8 presents a one-way ANOVA of the pretest to posttest Algebra 1 change scores for non-classified students by class type. The Bonferroni post-hoc analysis indicated that the *Interventionist Year 1* group had significantly higher mean change scores compared to the *Specialist B Year 2* group.

Table 4.8 identifies the overall mean change for classified students in the instructional models. The overall change for all the models was statistically significant, suggesting that students with disabilities made statistically significant gains within the models. The largest mean changes were noted within the *Interventionist Year 1* and the

Table 4.8

One-Way ANOVA of Pretest to Posttest Algebra 1 Change Scores for Classified Students by Class Type (N = 64)

Variable	*n*	Pre/Posttest Change *M (SD)*	*F(df)*	*p*
Change by Class Type			3.59 (7, 56)	.003[1]
Departmentalized Year 1	9	53.22 (11.87)		
Specialist A Year 1	7	34.86 (7.97)		
Interventionist Year 1	9	55.56 (13.07)		
Specialist B Year 1	7	38.57 (14.18)		
Specialist A Year 2	7	44.86 (12.10)		
Interventionist Year 2	7	51.14 (6.31)		
Specialist B Year 2	10	33.80 (19.21)		
Specialist C Year 2	8	40.83 (11.83)		

Note. [1]Bonferroni post-hoc analysis indicated that the *Interventionist Year 1* group had significantly higher mean change scores compared to the *Specialist B Year 2* group.

Departmentalized, Year 1 model. Academic year 2 illustrated statistically significant gains in the *Specialist A, Year 2* model as well as the *Interventionist, Year 2* model.

Hypothesis 3. What is the average growth, if any for students in ninth-grade Algebra I who are enrolled in the interventionist co-teaching, specialist co-teaching or departmentalized co-teaching instructional model over a 1-year period.

Data indicated that the alternative hypothesis is supported regarding hypothesis 3. Specifically, Table 4.9 presents a repeated-measures MANOVA analysis of changes in Algebra 1 scores from pretest to posttest, overall, as well as by class type for all students. The analysis indicated that the overall change in mean scores from pretest (M = 18.05, SD = 11.73) to posttest (M = 64.37, SD = 9.64) was statistically significant, F(1, 186) =

2388.77, $p < .001$. Further analysis indicated that changes in Algebra 1 scores did vary by class type at a statistically significant level, $F(7, 179) = 9.19$, $p < .001$. Figure 4.5 shows a plotted graph display of these relationships.

Table 4.9 identifies the overall change in pretest to posttest scores for all students in each instructional model. The overall change for all models was statistically significant as well as the change within each model. The largest noted growth was within the *Departmentalized, Year 1* model as well as the *Interventionist, Year 1* model. For the academic year 2015-2016, the largest growth changes were within the *Interventionist, Year 2* and the *Specialist C, Year 2*.

Figure 4.5 identifies the overall change in pretest to post test scores for all students in each instructional model. The overall change for all models was statistically significant as well as the change within each model. The largest noted growth was noted

Table 4.9
Repeated Measures MANOVA of Changes in Study from Pretest to Posttest Algebra Scores for All Students (N = 187)

Variable	*N*	Pretest *M (SD)*	Posttest *M (SD)*	*F(df)*	*p*
Overall Change	187	18.05 (11.73)	64.37 (9.64)	2344.77 (1, 186)	.001[1]
Change by Class Type				9.19 (7, 179)	.001[2]
Departmentalized Year 1	21	11.81 (8.09)	65.48 (10.97)		
Specialist A Year 1	23	32.61 (9.40)	70.87 (9.45)		
Interventionist Year 1	23	12.78 (6.85)	70.43 (10.07)		
Specialist B Year 1	19	23.63 (9/19)	66.26 (9.36)		
Specialist A Year 2	23	16.00 (9.05)	62.48 (7.98)		
Interventionist Year 2	25	12.78 (9.74)	60.36 (6.51)		
Specialist B Year 2	28	24.93 (12.37)	69.29 (8.26)		
Specialist C Year 2	25	9.88 (6.09)	58.27 (7.82)		

Note. [1]PES effect size = .93 (large effect size); [2]PES effect size = (small effect size)

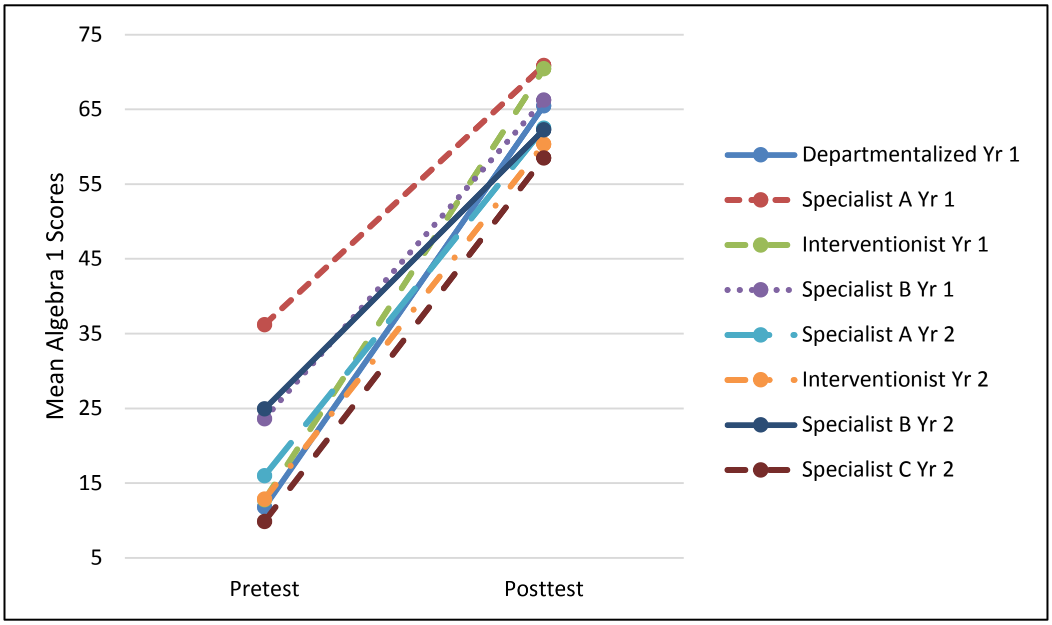

Figure 4.5. Graph of Changes in Study from Pretest to Posttest Algebra 1 Scores by Class Type for All Students (N = 187).

within the *Departmentalized, Year* 1 model as well as the *Interventionist, Year 1* model. For the academic year 2015-2016, the largest growth changes were within the *Interventionist, Year 2* as well as the *Specialist C, Year 2*.

Table 4.10 presents a one-way ANOVA of the pretest to posttest Algebra 1 *change scores* for non-classified students by class type. The Bonferroni post-hoc analysis indicated that the *Departmentalized, Year 1* group had significantly higher mean change scores compared to the *Specialist A, Year 1* group and the *Specialist B, Year 2* group. Furthermore, the post-hoc analysis indicated that the *Interventionist, Year 1* group had significantly higher mean change scores compared to the *Specialist A, Year 1* group, the *Specialist B, Year 1* group, the *Specialist A, Year 2* group, and the *Specialist B, Year 2* group. Additionally, the post-hoc analysis indicated that the *Interventionist, Year 2* group had significantly higher mean change scores compared to the *Specialist B, Year 2* group.

Lastly, the post-hoc analysis indicated that the *Specialist C, Year 2* group had significantly higher mean change scores compared to the *Specialist A, Year 1* group and the *Specialist B, Year 2* group.

Table 4.10 reveals that the overall change for all students was statistically significant with a p value of .001. The largest mean change was noted in the *Departmentalized, Year 1* as well as the *Interventionist, Year 1* models for academic year 2014-2015, as well in the *Interventionist, Year 2* and *Specialist C, Year 2* models for academic year 2015-2016.

Table 4.10

One-Way ANOVA of Pretest to Posttest Algebra 1 Change Scores for All Students by Class Type (N = 187)

Variable	*N*	Pre/Posttest Change *M (SD)*	*F(df)*	*p*
Change by Class Type			9.19 (7, 179)	.001[1]
Departmentalized Year 1	9	53.67 (10.23)		
Specialist A Year 1	7	38.26 (11.02)		
Interventionist Year 1	9	57.65 (11.22)		
Specialist B Year 1	7	42.63 (11.26)		
Specialist A Year 2	7	46.48 (9.76)		
Interventionist Year 2	7	47.48 (9.08)		
Specialist B Year 2	10	37.36 (15.14)		
Specialist C Year 2	8	48.64 (10.98)		

Note. [1]Bonferroni post-hoc analysis indicated that the Departmentalized Year 1 group had significantly higher mean change scores compared to the Specialist A Year 1 group and the Specialist B Year 2 group.

Summary of Results

The purpose of this chapter was to report on the effectiveness of three local instructional models in bringing about improved student outcomes in ninth-grade

Algebra I. The researcher was interested in learning if any of the three local co-teaching models, spread across the four sections (interventionist, specialist, or departmentalized), produced significantly better or worse student outcomes in Algebra I. These instructional models covered under this study are being used in a local high school in an urban area in Westchester County, NY.

The interventionist model is an instructional model in which an individual who is New York State certified in special education supports classified students in all of their academic classes (English, mathematics social studies, and science) as well as in their academic-support class. The special education teacher is not mathematics certified. He or she co-teaches in a classroom with a general education teacher who is certified in the content area being taught. The special education teacher is in all of the academic classes with the students and teaches a separate, self-contained academic-support class.

The specialist model is an instructional model in which a teacher, who is New York State certified in mathematics and special education, co-teaches with an individual who is New York State certified in mathematics. The special education teacher only teaches in the academic class for which he or she is certified (mathematics). There are two sections of the specialist model, making four separate pairings of co-teachers for this model. One of the four special education teachers provides a self-contained academic-support class for the students assigned to this co-teaching model.

The third model is the departmentalized model. In this instructional model, a certified special education and biology teacher for 7-12 co-teaches Algebra I with a certified general education mathematics teacher for Grades 7-12. Further, the biology teacher acts as the special education co-teacher in a science class with the same students in the Algebra 1 class.

The results indicate that the overall mean change was highest for non-classified students in the *Departmentalized, Year 1* as well as in the *Interventionist, Year 1* model. For academic year 2, *Specialist A, Year 2* as well as *Specialist C, Year 2* also illustrated the most statistically significant mean changes.

The largest mean changes for classified students were noted within the *Interventionist, Year 1* and *Departmentalized, Year 1* model. Academic year 2 illustrated statistically significant gains in the *Specialist, A Year 2* model as well as the *Interventionist, Year 2* model.

The largest mean change for students overall was noted in the *Departmentalized, Year 1* as well as *Interventionist, Year 1* models. For academic year 2015-2016, the largest mean change was noted within the *Interventionist, Year 2* and *Specialist C, Year 2* models. These results illustrate that the models were effective in producing outcomes for students, however, it is interesting to note that not all students benefitted academically from the same models. Overall, the model that most frequently produced the most significant change in student test scores was the Interventionist model, the model in which one special education teacher supported special education students in all academic area classes as well as in a study skills class. This point is further explained in Chapter 5.

Chapter 5: Discussion

Introduction

This chapter reviews the implications, limitations, and recommendations for the study that was completed. The objective of this study was to determine if any of the three local models, distributed over four sections of co-teaching over 2 years in ninth-grade Algebra I produced better student outcomes. Algebra was selected for this study because all students in New York State (NYS) are required to pass a mathematics Regents exam in order to fulfill state requirements to graduate with a Regents diploma. The mathematics exam that is considered to be most important to pass and the one the overwhelming majority of students take is ninth-grade Algebra I.

Algebra has been linked to success and matriculation in post-secondary education. "Mathematical structures form the basis of our number system and provide the underlying foundation" (Christy & Sparks, 2015, p. 37). Mathematics, in particular algebra, provides foundational skills for students. In 2001, Rose and Betts, identified the correlation between high school curriculum, college graduation, and earnings. The results of their study showed that "Math curriculum has a strong effect on the probability of graduating from college" (p. xix).

Over the years, classified students have found Algebra I particularly challenging, and teachers and administrators have applied many instructional strategies and classroom configurations to support these students. The model most employed to assist classified students has been co-teaching. However, "despite the proliferation of co-teaching"

(Walther-Thomas, Bryant, & Land, 1996, p. 1), research into its effectiveness is extremely limited, especially at the secondary level" (Magiera & Zigmond, 2005, p. 3). This lack of quantitative data regarding the effectiveness of co-teaching supports that there is "currently, a need for more empirical research in the area of co-teaching" (Dieker & Murawski, 2003, p. 4).

The purpose of this study was to determine quantitatively which of these local models utilized in a local high school produced better student outcomes. This information may help to add to the body of research around co-teaching as well as to provide evidenced based information to local districts when selecting and staffing instructional models that are most likely to improve student outcomes.

This study has its theoretical bases in the work of Lev Vygotsky (1968) and his theory of social constructivism and notion of the zone of proximal development. Vygotsky argued that when placed with more capable peers, students are able to achieve more due to the fact that they have access to appropriate learning models and to the regular curriculum. Piaget's (1964) theory regarding childhood development also framed the study to explain the developmental milestones children encounter.

Jean Piaget (1964) wrote about the developmental stages that students encounter when they are learning new information. "Cognitive development is the reorganization of mental structures, which occurs when a person spontaneously acts on the environment (transforms it), experiences disequilibrium, and assimilates and accommodates events"

(Wadsworth, 1978, p. 29). According to Piaget (1964), the four stages of development are:

1. Sensorimotor
2. Preoperational
3. Concrete
4. Formal

These four stages describe the milestones that children reach. In *sensorimotor*, "the important milestone is the interaction of the child with his or her senses and the environment" (Piaget, 1964, p. 20). The second stage *preoperational* is where the intuitive mode of thought prevails. It is often "characterized by free association, fantasy, and unique illogical meaning" (p. 21). The *concrete* stage has "two main milestones for the child to learn fundamental skills in reading, writing, and calculating arithmetic problems as well as be able to accept his/her own aptitude for school" (p. 21). The final stage, also known as *formal*, is the one in which the student is capable of considering the ideas of others and communicating with them, since "he/she is well into the socialized speech phase of language development" (Piaget 1964, p. 21).

At each stage, one reaches a new milestone. Linking it to Vygotsky (1968), one can assume that when placed in settings with typical peers, students with disabilities would be provided with models of typical development that they could mirror.

Research Questions

This research was guided by the research questions, along with null and alternative hypotheses, and the data provided answers to those questions:

1. Is there a difference in student outcomes in Algebra I for non-classified students enrolled in the interventionist co-teaching, specialist co-teaching, or departmentalized instructional model?
   (a) Null Hypothesis 1: There is no difference in student outcomes in Algebra I for non-classified students enrolled in the interventionist co-teaching, specialist co-teaching, or departmentalized instructional model.
   (b) Alternative Hypothesis 1: There is a difference in student outcomes in Algebra I for non-classified students enrolled in the interventionist co-teaching, specialist co-teaching, or departmentalized instructional model.
2. Is there a difference in student outcomes in Algebra I for classified students enrolled in the interventionist co-teaching, specialist co-teaching, or departmentalized instructional model?
   (a) Null Hypothesis 2: There is no difference in student outcomes in Algebra I for classified students enrolled in the interventionist co-teaching, specialist co-teaching, or departmentalized instructional model.
   (b) Alternative Hypothesis 2: There is a difference in student outcomes in Algebra I for classified students enrolled in the interventionist co-teaching, specialist co-teaching, or departmentalized instructional model.
3. What is the average growth, if any, for students in ninth-grade Algebra I who are enrolled in the interventionist co-teaching, specialist co-teaching, or departmentalized co-teaching instructional model over a 1-year period.

The data suggest that these objectives were accomplished. The results of this study indicate findings that can help to structure and implement co-teaching instructional models to better meet the needs of all learners. The results indicate that all the students enrolled in co-teaching models demonstrated statistically significant growth. However, some models showed a greater statistical significance for certain groupings of students.

The overall mean change for all non-classified students reveals that in year 1 of the study, *Departmentalized* model (science-certified special education teacher paired with a mathematics-certified teacher) and the *Interventionist* model (general special education teacher along with a mathematics-certified teacher) models had the highest mean changes when compared to other models. For academic year 2, *Specialist A*, as well as *Specialist C* also showed statistically significant mean changes. In this model, a certified mathematics teacher was paired with a dually-certified special education and mathematics teacher.

The students with disabilities' largest mean changes were noted within the Interventionist Year 1 (general special education teacher and mathematics teacher) and Departmentalized Year 1, (biology, special education teacher, and mathematics teacher) model. Academic Year 2 illustrated statistically significant gains in the Specialist A, Year 2 (mathematics/special education and mathematics teacher) model as well as the Interventionist, Year 2 (special education and mathematics teacher) model. The results suggest that students with disabilities made statistically significant gains in all three co-teaching models. However, the largest gains for classified students occurred in the models that were staffed by a 7-12, mathematics-certified teacher along with a special education teacher who remains with the same students for all four academics classes, plus in a support, resource room class.

Finally, the overall change for all students within the models was noted in the *Departmentalized, Year 1* (science special education teacher and mathematics teacher) as well as the *Interventionist, Year 1* (special education teacher and mathematics teacher) models. For academic year 2015-2016, the largest mean change was noted within the *Interventionist, Year 2* (special education teacher and mathematics teacher) and *Specialist C, Year 2* (mathematics/special education and mathematics teacher) models. The implications of these findings are explored in the next section.

Implications

As stated, the results of this study reveal that all co-teaching models created growth for both classified and non-classified students. These results are in agreement with previous quantitative research completed by Walsh in 2012, which show noted academic growth for elementary students, Grades 3-8, in the Howard County Schools in Maryland, who participated in an integrated co-teaching model. Walsh (2012) stated that:

> The comparison of overall Grades 3-8 student performance by students with disabilities between 2003 and 2009 on state assessments indicates that students with disabilities increased proficiency in reading at twice the rate (22%) as did students overall (11%) and nearly twice the rate (22%) in mathematics compared with students overall (13%). The achievement acceleration demonstrated over this time period represents a true closing of the achievement gap for students with disabilities within Howard County, largely attributed to the implementation and support of co-teaching. (p. 36)

Walsh (2012) supported the conclusion that co-teaching produces better results for classified students in Grades 3-8. Importantly, it shows that students with disabilities are able to achieve at comparable, or higher, levels in comparison to their general education peers when placed in these classrooms. This study provides quantitative data which supports a similar conclusion for ninth-grade Algebra I.

Scruggs et al. (2007) completed a quantitative meta-synthesis of the research on co-teaching. “Previous reviews of co-teaching have summarized accumulated literature and identified important variables” (Scruggs et al., 2007, p. 393). “Based on these previous reviews (of literature),” Scruggs et al., “concluded that available efficacy data are generally positive, but limited” (p. 394). The meta-synthesis focused on the body of work regarding co-teaching, and it was “an attempt to integrate systematically a large body of related research literature” (p. 394). In other words, the data on the instructional effectiveness of co-teaching is generally positive, but it is limited. The preponderance of research and literature is qualitative and deals with teacher perceptions of working in a co-teaching model. Literature also examines teacher roles and responsibilities within the pairing. What emerged is the one teach, one drift model. This model may not allow teachers to maximize their expertise to support the students because one of the teachers is often leading the lesson, while the other is supporting the students individually as needed.

This current meta-synthesis further focused on the teachers’ perceptions regarding the roles and responsibilities within this pairing. It raised concerns, such as sharing responsibilities within the classroom, as well as differentiating and educating all students in the classroom.

This current study did not address, directly, the pedagogy nor the specific division of roles and responsibilities between the co-teachers in the three models. However, what emerged from these findings regarding the pairing of a teacher was that a special education teacher who supports students in all academic classes produced statistically significant student results. In other words, a special education teacher who is with the same students throughout their academic classes and who knows his or her students well is likely to achieve better student outcomes. This is an important finding as it reinforces the fact that relationships that are developed between teacher and student do impact overall learning (Jennings & Greenberg, 2009).

The result of this study indicated that across all coteaching models over 2 years, students made statistically significant gains. Applications for this study would be to use, create, and implement the co-teaching models for Algebra I. The fact that the departmentalized model (biology/special education teacher and mathematics teacher) produced higher mean changes is important to note; however, it is difficult to assess because the model was only in use for one academic year. In terms of applications to the district that provided the data for the study, it would be advantageous for the selected district to continue to obtain data regarding the various co-teaching models and replicate it to compare the results.

Limitations

This study was conducted in a large, diverse urban high school located in the Northeast. Weaknesses of the study were noted regarding the amount of data collected. There were only 2 years of data that were accessible for the study. Having more data available would have provided a more robust analysis of student outcomes. The local models that were studied also may not be utilized in neighboring schools, thus these results may not be directly applicable. Further, the departmentalized model was in effect for 1 year of the study. Although it had statistical significance in terms of overall growth, it did not have a counterpart to note if there was growth the second year.

Another limitation was that there were staffing changes over the course of the 2 years in the study. As there was no staffing continuity, it was difficult to assess how teacher changes impacted the effectiveness of this study. It should be noted that the configuration of teachers changed, however, the teams based on their certifications did not. In addition, this study did not control for staffing changes within the same model year to year. The final limitation noted within this study was that the data were organized and sorted by the researcher to protect the anonymity of the pretest and posttest scores as well as any identifying features related to the subjects. If an error was made with the data cleaning, it could not be noted because only one person had access to the data.

Recommendations

Based on the results, special attention should be given to models that connect teachers to students across subjects and high school periods, as long as these teachers are paired with a content specialist and general education teacher that know students well. "Students who perceive that their teachers have high expectations of their academic achievement are more motivated to try to meet those expectations and perform better academically than their peers who perceive low expectations from their teachers (Muller, Katz, & Dance, 1999, p. 1). "Due to the influence of expectations on motivation, expectations can be an important factor on a students' academic achievement." (Gallagher, 2013, para 2). One can argue that the reason the interventionist model was significant was due to the relationship building that also occurred over that school year which helped students achieve success.

For the models in which statistical significance was noted it would be advantageous for the district to continue use of these instructional models as the data showed that students made statistically significant gains. However, it is further recommended that the school district that implements these models, also conducts this study again after 3 years. The school district should also maintain, as much as possible, the same teams of teachers to determine if either model is producing better outcomes.

A major topic of concern regarding students with special needs is the idea of inclusion. NYS defines inclusion as least restrictive environment (LRE) meaning that whenever possible, students should be educated in classrooms that provide access and opportunity to participate in the general education curriculum. However, with increasing state and federal mandates regarding education for students, schools—at times—are unsure how to best provide access to students with a variety of educational disabilities.

More research should be completed on the educational classification of the students and whether students with a particular educational classification, such as autism, other health impairment, or learning disability, perform better in any of the selected instructional models. It would be important to learn if an even broader range of students with educational disabilities could be successful in these co-teaching models to help them exceed their perceived ability. Often, more severely handicapped students are included in co-teaching classrooms as a way to provide access and support to the general education curriculum. This can become a very highly-charged issue in terms of creating and implementing programs to meet the academic needs of diverse learners. Further research into student outcomes related to classification would help schools better understand the students that are best supported by these instructional models.

Another recommendation lies within the purview of the state and federal government. Co-teaching is not mandated in the continuum of services for students with special needs. Given that situation, schools are not mandated to provide co-teaching for students with disabilities (NYSED, 2015). Yet, the research does illustrate that this is a worthwhile model for schools to employ. This research could be used to support policymakers and advocates who are concerned with the learning outcomes of students with disabilities. Such a public policy mandate enshrined in special education law would preclude school districts from denying this service to classified students for budgetary reasons.

Further research should be conducted on the performance of students that are asked to retake the algebra Regents to determine if the extra year of exposure to the course material produces higher rates of student success. It would also be advantageous for the district to complete this study with the pretest and posttest test results of the English Regents exam. As this is an exam, similar to the Mathematics Regents exam that must be passed by students in order to meet graduation requirements, it would be interesting to note the growth made by students within the co-teaching settings.

Finally, as the demographic of the school featured in this study is similar to that of NYS as a whole, it would be interesting to replicate it in other large and small districts across the state to see if the co-teaching models produce similar significant results. This research also can advance the cause of social justice schools that utilize co-teaching are creating environments in which students with educational disabilities are included in the general education setting and show statistically significant gains in test outcomes that help to close the achievement gap between classified and general education students. The use of these models, as shown in the research creates gains for both classified and non-classified students (Scruggs et al., 2007; Walsh, 2012).

Conclusion

Co-teaching is a service model that delivers education to students with and without disabilities within a general education setting. The instruction is delivered jointly by both a special education and a general education teacher. This study focused on four sections of three different models of co-teaching and compared the test outcomes of students enrolled in these models. The outcomes were analyzed for both students with disabilities as well as general education students.

This research was conducted to determine which model, if any, produces better student outcomes on the Algebra I Regents exam. Data was accessed retrospectively and reviewed from the 2013-2014 and 2014-2015 academic school years. By using pretest and posttest assessments, the researcher was able to note if any of the models produced statistically significant student outcomes.

This historical context and research related to co-teaching and mathematical practices was further reviewed by the researcher. Much of the research currently available is qualitative in nature and focuses on the perceptions of students and faculty in their instructional settings. There is very little quantitative data on the instructional effectiveness of co-teaching, particularly at the high school level. This study was a response to that need.

Special education law mandates that classified students be placed in the least restrictive environment. This means that a student with disabilities must have access to the general education curriculum and be included with his or her general education peers to the maximum extent possible in pursuit of their learning goals. This mandate challenges special education administrators and all general education teachers to meet the needs of diverse learners.

The researcher selected this topic because, as the Chairperson of the Committee on Special Education, I have to make decisions daily to meet the educational and programmatic needs of students with educational disabilities. Within this decision-making framework, integrated co-teaching is most often considered as a recommended service to provide support and access for the general education curriculum. However, there is scant data to conclude that these models are most effective in terms of increasing student test outcomes.

The selected district educates over 500 students within the high school who are classified as having educational disabilities. The co-teaching instructional model is offered at every grade level (9, 10, 11, 12). This research provides, for the first time, empirical data for the co-teaching models used in Grade 9, Algebra I that demonstrates relative effectiveness among the models in student test outcomes.

These results indicate that all co-teaching models showed growth for all students. The most significant results occurred in the interventionist model in which one special education teacher co-teaches in all academic areas as well as provides support in a study skills class. Jennings and Greenberg (2009) stated:

> Socially and emotionally competent teachers set the tone of the classroom by developing supportive and encouraging relationships with their students, designing lessons that build on student strengths and abilities, establishing and implementing behavioral guidelines in ways that promote intrinsic motivation,

> coaching students through conflict situations, encouraging cooperation among students, and acting as a role model for respectful and appropriate communication and exhibitions of prosocial behavior. (p. 492)

This quote illustrates just how critical teacher expectations and emotional connections are to student success. This supports the results of this study as the model that consistently showed large mean growth with the interventionist pairing.

It would benefit the selected school to continue to support the co-teaching models as they do help create statistically significant growth. However, this study should be replicated to determine the overall effectiveness of the models in all subjects and at all grade levels. It would be interesting to complete this study again with more data and in different schools to continue to add to the quantitative body of knowledge.

This study can be used to create programs that continue to support all students, regardless of educational need. It can also help to create environments that are more inclusive and representative of people who may learn differently. It has been the goal of this researcher to begin to look at the overall effectiveness of these often-utilized models to determine whether they are benefitting students. “This is not just a disability issue. It’s about providing the best education and the best support for all students” (University of Kansas, 2016, para. 15). Remembering that inclusion classrooms serve both general education and special education students helps to galvanize districts to make sure that all students are benefitting from the instruction occurring within that setting.

To continue to create a community of inclusion for all students regardless of educational classification, Stiker (1999) posited that:

> We must then inscribe in our cultural models a view of difference as the law of the real. It is a matter of stating and restating, first of all to children throughout their education, that it is inscribed in the human universe to value the differences it engenders and of which it is also a product. (p. 12)

Stiker (1999) challenged all educators to help students, faculty, and staff understand that all students learn differently and to continue to build educational programs that help all students achieve academic success. We should continue to create schools and educational programs that celebrate the differences in our students and help them capitalize upon their strengths.

References

Bauwens, J., Hourcade, J. J., & Friend, M. (1989). Cooperative teaching: A model for general and special education integration. *Remedial & Special Education, 10*(2), 7-22.

Boyd, M. (2013). *Co-teaching: Perceptions of urban, secondary co-teachers* (Doctoral dissertation). Retrieved from ProQuest. (UMI 357401)

Brown v. Board of Education. (1954). *Legal Information Institute.* Retrieved from https://www.law.cornell.edu/supremecourt/text/347/483

Carlberg, C., & Kavale, K. (1980) The efficacy of special versus regular class placement for exceptional children: a meta-analysis. *The Journal of Special Education, 14*(3), 295-309.

Christy, D., & Sparks, R. (2015). Abstract algebra to secondary school algebra: Building bridges. *Journal of Mathematics Education at Teachers College, 6*(2), 37-42.

Common Core State Standards Initiative. (2017). *Development process.* Retrieved from http://www.corestandards.org/about-the-standards/development-process/

Conderman, G. (2011). Middle school co-teaching: Effective practices and student reflections. *Middle School Journal, 42*(4), 24-31.

Cook, L., & Friend, M. (1995). Co-teaching: Guidelines for creating effective practices. (cover story). *Focus on Exceptional Children, 28*(3), 1-16.

Dieker, L. A., & Murawksi, W. W. (2003). Co-teaching at the secondary level: Unique issues, current trends and suggestions for success. *High School Journal, 86*(4), 1-3.

Eccleston, S. T. (2010). Successful collaboration: Four essential traits of effective special education specialists. *The Journal of International Association of Special Education, 11*(1), 40-47.

Education for All Handicapped Children Act of 1975, P.L. 94-142, 89 Stat. 773. (1975).

Elkind, D. (2005). Objectivism and education: A response to David Elkind's 'The problem with constructivism.' *The Educational Forum*, *69(4),* 328-334.

Engage NY. (2014). Retrieved from https://www.engageny.org/

Editorial Projects in Education. (2015). Retrieved from http://www.edweek.org/ew/section/multimedia/no-child-left-behind-overview-definition-summary.html?intc=highsearch

Erbas, A. K. (2005). Predicting Turkish ninth grade students' algebra performance. *Mathematics Educator, 15*(1), 25-34.

Fore, C., Hagan-Burke, S., Burke, M. D., Boon, R. T., & Smith, S. (2008). Academic achievement and class placement in high school: Do students with learning disabilities achieve more in one class placement than another? *Education and Treatment of Children, 31*(1), 55-72.

Friend, M., Reising, M., & Cook, L. (1993). Co-teaching: An overview of the past, a glimpse at the present, and considerations for the future. *Preventing School Failure,* 37(4), 6-10. doi:10.1080/1045988X.1993.9944611

Gallagher, E. (2013). The effects of teacher-student relationships: Social and academic outcomes of low-income middle and high school students. *NYU | Steinhardt, Department of Applied Psychology.* Retrieved from http://steinhardt.nyu.edu/appsych/opus/issues/2013/fall/gallagher

Gerber, P. J., & Popp, P. A. (1999). Consumer perspectives on the collaborative teaching model views of the students with and without LD and their parents. *Remedial and Special Education, 20*(5), 288-296.

Hang, Q., & Rabren, K. (2009). An examination of co-teaching perspectives and efficacy indicators. *Remedial and Special Education, 30*(5), 259-268.

Hornby, G. (1999). Inclusion or delusion: Can one size fit all? *Support for Learning, 14*(4), 152-157.

IDEA Partnership. (n.d.). *Dialogue guides: IDEA regulations.* Retrieved from http://www.ideapartnership.org/index.php?option=com_content&view=article&id=843&oseppage=1

Jennings, P. A., & Greenberg, M. T. (2009). The prosocial classroom: Teacher social and emotional competence in relation to student and classroom outcomes. *Review of Educational Research, 79*(1), 491-525. doi:10.3102/0034654308325693

Judge, S., & Watson, S. M. R. (2011). Longitudinal outcomes for mathematics achievement for students with learning disabilities. *The Journal of Educational Research, 104*(3), 147-157.

King-Sears, Margaret E., Brawand, Anne Eichorn, Jenkins, Melissa C., & Preston-Smith, Shantha. (2014). Co-Teaching Perspectives from Secondary Science Co-Teachers and Their Students with Disabilities. *Journal of Science Teacher Education, 25*(6), 651-680.

Klingner, J. K, Vaughn, S., Hughes, M. T., Schumm, J. S., & Elbaum, B (1998). Outcomes for students with and without learning disabilities in inclusive classrooms. *Learning Disabilities Research & Practice, 13*(3), 153-161.

Laerd Statistics. (2016). *The ultimate IBM SPSS statistics guides.* Retrieved from https://statistics.laerd.com/

Magiera, K., & Zigmond, N. (2005). Co-teaching in middle school classrooms under routine conditions: Does the instructional experience differ for students with disabilities in co-taught and solo-taught classes? *Learning Disabilities Research & Practice, 20*(2), 79-85.

Mallory, B. L., & New, R. S. (1994). Social constructivist theory and principles of inclusion: Challenges for early childhood special education. *The Journal of Special Education, 38*(3), 322-337.

McDuffie, K. A., Mastropieri, M. A., & Scruggs, T. E. (2009). Differential outcomes of peer-tutoring in co-taught and non-co-taught classes: Results for content learning and student-teacher interactions. *Exceptional Children, 75*(4), 493-510.

McLeskey, James, & Waldron, Nancy L. (2007). Making Differences Ordinary in Inclusive Classrooms. *Intervention in School and Clinic, 42*(3), 162-168.

McLeskey, J., & Waldron, N. L. (2007). Establishing a collaborative school culture through comprehensive school reform. *Journal of Educational and Psychological Consultation, 42*(3), 162-168.

Mertens, D., & Wilson, A. (2012). *Program evaluation and theory a comprehensive guide.* New York, NY: The Guilford Press

Muller, C., Katz, S. R., & Dance, L. J. (1999). Investing in teaching and learning dynamics of the teacher-student relationship from each actor's perspective. *Urban Education, 34*(3), 292-337.

Murawski, W. W., & Swanson, H. L. (2001). A meta-analysis of co-teaching research: Where are the data? *Remedial and Special Education, 22*(5), 258-267.

New York State Education Department. (2013, November). *Continuum of special education services for school-age students with disabilities – Questions and answers.* Retrieved from http://www.p12.nysed.gov/specialed/publications/policy/schoolagecontinuum-revNov13.htm#inte

New York State Education Department. (2015). *Special education: Part 200.1 definitions.* Retrieved from http://www.p12.nysed.gov/specialed/lawsregs/sect2001.htm.

New York State Education Department. (2016). *NY State – School report card data [2014-15]*. Retrieved https://data.nysed.gov/reportcard.php?instid=800000081568&year=2015&createreport=1&regents=1

New York State Education Department. (2017). *TEACH system.* Retrieved from http://www.highered.nysed.gov/tcert/teach/

Peters, E., & Johnson, T. (2006, December 1). Thriving in the co-taught classroom. *National Teachers Science Association.* Retrieved from http://www.nsta.org/publications/news/story.aspx?id=53006

Pham, Y. K., & Murray, C. (2016). Social relationships among adolescents with disabilities: Unique and cumulative associations with adjustment. *Exceptional Children, 82*(2), 234-250.

Piaget, J. (1964). Development and learning. In R.E. Ripple & V. N. Rockcastle (Eds.), *Piaget rediscovered* (pp. 7-20). Ithaca, NY: Cornell University.

Plessy v. Ferguson, 163 U.S. 537. (1896). Retrieved from https://www.law.cornell.edu/supremecourt/text/163/537

Purzer, S. (2011). The relationship between team discourse, self-efficacy, and individual achievement: A sequential mixed-methods study. *Journal of Engineering Education*, *100*(4), 655-679.

Raviv, A. (2010). Between two evils: stands and difficulties of teachers integrating pupils with special needs in their classes. *The International Journal of Learning, 17*(9), 207-226.

Rose, H, & Betts, J. (2001). *Math matters: The links between high school curriculum, college graduation and earnings.* San Francisco, CA: Public Policy Institute of California.

Royer, J. M. (2003). *Mathematical cognition. A volume in current perspectives on cognition, learning, and instruction.* Greenwich, CT: Information Age Publishing.

Scruggs, T. E., Mastropieri, M. A., & McDuffie, K. A. (2007). Co-teaching in inclusive classrooms: A metasynthesis of qualitative research. *Council for Exceptional Children, 73*(4), 392-416.

Simatwa, E. M. W. (2010). Piaget's theory of intellectual development and its implication for instructional management at pre- secondary school level. *Educational Research and Reviews, 5*(7), 366-371.

Sivan, E. (1986). Motivation in social constructivist theory. *Educational Psychologist, 21*(3), 209-233.

Snipes, J., & Finkelstein, N. (2015). Opening a gateway to college access: Algebra at the right time. San Francisco, CA: Regional Education Library West at WestEd.

Statistics How To. (2017). *More on the Bonferroni correction.* Retrieved from http://www.statisticshowto.com/post-hoc/#PHbonferroni

Stiker, H.-J. (1997). *A history of disability.* Ann Arbor, MI: University of Michigan Press.

Stoelinga, T., & Lynn, J. (2013). Algebra and the unprepared learner. *UIC Research on Urban Education Policy Initiative Policy Brief. Vol. 2 (3)*

TASH. (2009, July 9). *Inclusive education and implications for policy: The state of the art and the promise.* TASH Congressional Briefing on Inclusive Education. Washington, DC: TASH.

The University of Kansas. (2016, March 29). Study shows students with, without disabilities recognize benefits of inclusive schools. *KU School of Education*. Retrieved from https://soe.ku.edu/cherry-picked-study-shows-students-without-disabilities-recognize-benefits-inclusive-schools

Thomas, J. Y., & Brady, K. P. (2005). The Elementary and Secondary Education Act at 40: Equity, accountability, and the evolving federal role in public education. *Review of Research in Education, 29*, 51-67. doi:10.3102/0091732X029001051

Thomson Reuters WESTLAW. (2017). *8 CRR-NY 80-5.3: Incidental teaching.* Retrieved from https://govt.westlaw.com/nycrr/Document/I364d11c8c22211ddb29d8bee567fca9f?viewType=FullText&originationContext=documenttoc&transitionType=CategoryPageItem&contextData=(sc.Default)&bhcp=1)

U.S. Department of Education. (2004a). *New No Child Left Behind: Highly qualified teachers* (Fact Sheet). Retrieved from http://www2.ed.gov/nclb/methods/teachers/hqtflexibility.html

U.S. Department of Education. (2004b). *Individuals with Disabilities Education Act 2004.* Retrieved from http://idea.ed.gov/explore/home

U.S. Department of Education. (2010). *Free appropriate public education for students with disabilities: Requirements under Section 504 of The Rehabilitation Act of 1973.* Retrieved from http://www2.ed.gov/about/offices/list/ocr/docs/edlite-FAPE504.html

U.S. Department of Education. (2012). *The IDEA 35th anniversary.* Retrieved from www2.ed.gov/about/offices/list/osers/idea35/index.html

U.S. Department of Education. (2015). *Every Student Succeeds Act.* Retrieved from http://www.ed.gov/essa?src=rn

Vygotsky, L. S. (1978). *Mind in society the development of higher psychological processes.* Cambridge, MA: Harvard University Press.

Wadsworth, B. (1978). *Piaget for the classroom teacher*. New York, NY: Longman.

Waldron, N., & McLeskey, J. (1998). The effects of an inclusive school program on Students with mild and severe learning disabilities. *Exceptional Children, 64*(3), 395-405.

Walsh, J. M. (2012). Co-teaching as a school system strategy for continuous improvement. *Preventing School Failure, 56*(1), 29-36.

Walther-Thomas, C. S. (1997). Co-teaching experiences: The benefits and problems that teachers and principals report over time. *Journal of Learning Disabilities, 30*(4).

Walther-Thomas, C., Bryant, M., & Land, S. (1996). Planning for effective co-teaching. *Remedial & Special Education, 17*(4), 255-264.

Wolffensperger, Y., & Patkin, D. (2013). It takes two to develop professional knowledge: A case study. *Teacher Education and Practice, 26*(1), 143-160.

Zigmond, N. (2003). Where should students with disabilities receive special education services? Is one place better than another? *The Journal of Special Education, 37*(3), 193-199.

Appendix A

Title of Appendix