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Examining the Relationship between Fidelity of Implementation of Accommodations for Students with Specific Learning Disabilities in Mathematics and Student Achievement in High School Algebra I Inclusion Classes

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EXAMINING THE RELATIONSHIP BETWEEN FIDELITY OF IMPLEMENTATION OF ACCOMMODATIONS FOR STUDENTS WITH SPECIFIC LEARNING DISABILITIES IN MATHEMATICS AND STUDENT ACHIEVEMENT IN HIGH SCHOOL ALGEBRA 1 INCLUSION CLASSES

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Belinda B. Baptiste

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To: Dean Michael R. Heithaus
College of Arts, Science and Education

This dissertation, written by Belinda B. Baptiste, and entitled Examining the Relationship between Fidelity of Implementation of Accommodations for Students with Specific Learning Disabilities in Mathematics and Student Achievement in High School Algebra 1 Inclusion Classes, having been approved in respect to style, intellectual content, is referred to you for judgment.

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DEDICATION

This dissertation is dedicated to my parents, Felix Emmanuel and Rita Ruby who instilled in me the importance of a good education and for teaching me that with God all things are possible. To my sister, Marva for her love and support throughout this journey and to Dorothy Reid for her prayers and encouragement.

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ABSTRACT OF THE DISSERTATION

EXAMINING THE RELATIONSHIP BETWEEN FIDELITY OF IMPLEMENTATION OF ACCOMMODATIONS FOR STUDENTS WITH SPECIFIC LEARNING DISABILITIES IN MATHEMATICS AND STUDENT ACHIEVEMENT IN HIGH SCHOOL ALGEBRA 1 INCLUSION CLASSES

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Students with specific learning disabilities (SLD) are educated in general education classrooms. As a result, these students are faced with more challenging instructional curricula. Although some students with SLD perform as well in mathematics as students without disabilities, most perform below state standards despite being provided instructional and testing accommodations. Policy makers have envisioned the implementation of instructional accommodations as a primary means of ensuring an appropriate education (Mcleskey, Hoppey, Williamson & Rentz, 2004; Scalon & Baker, 2012) for students with disabilities in general education classrooms (Mc Guire, Scott, & Shaw, 2006).

The researcher implemented a non-experimental ex post facto research design to investigate the research hypothesis to determine the relationship between the five most frequently used accommodations by general education teachers who teach students with SLD and student achievement in Algebra 1. At the beginning of the 2016 – 2017 school year, the collection of data began by emailing the Qualtrics Survey Software (V.23) to 185 general education mathematics teachers in Miami-Dade County Public Schools. Four main instructional accommodation constructs were assessed using a 15-item questionnaire. From the responses to the survey, the five of the most frequently used accommodations were determined. Nine general education Algebra 1 teachers from six high schools across the county who reported using similar accommodations and taught three or more students with SLD in mathematics participated in the study. The researcher and two peer researchers conducted in-class observations on the participants' fidelity of implementation of accommodations (FOI) using a checklist during the period in which they taught students with SLD. An Algebra I test was used for pre- and post-testing to determine student mathematics achievement.

The results of the survey indicated that teachers most frequently provided: (a) sample problems of varying levels, (b) guides or prompts or personal (teacher/peer) assistance, (c) extended access to instructional resources and equipment, (d) provided preferential seating and (e) additional time to complete assignment or class projects. Linear regression analysis revealed a significant positive relationship between teacher FOI of accommodations and student achievement ($p < .05$).

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CHAPTER I

INTRODUCTION

Today, students with disabilities are increasingly educated in general education classrooms in which they are learning alongside their non-disabled peers (Scalon & Baker, 2012). In fall of 2012, 95% of students with disabilities from ages 6 to 21 were served in general education classes (U.S Department of Education, 2016). According to the U.S. Department of Education (2006), the proportion of children with disabilities whose primary placement is in general education classrooms increased from 33% in 1992 to 48.9% in 2006. Moreover, state and federal mandates (i.e., Individuals with Disabilities Education Act [IDEA], 2004; No Child Left Behind [NCLB], 2002 reauthorized as Every Student Succeeds Act [ESSA], 2015) require students with disabilities to have access to a rigorous curriculum that prepares them to succeed in college, the workplace and the global economy. In addition to having access to a rigorous curriculum, by the end of the 2013-2014 school year, all students, including students with disabilities, were required to show academic proficiency on state standards in mathematics, as well as in other academic areas (Jitendra, 2013). Before these more recent requirements for academic outcomes, however, special education operated under federal mandates of accountability that emphasized primarily compliance with legally codified processes and as such, for the most part, students with disabilities were excluded from the general education instructional accountability system (Turnbull, Turnbull, Wheymyer, & Park, 2003).

Excluding students with disabilities meant that approximately 11% of school-aged students were not held to the same expectations as their non-labeled peers (Gagnon, Barker, & Van Loan, 2008; Maccini, Gagnon, Calvin, & Malmgren, 2008; Quinn, Rutherford, Leone, Usher, & Poirer, 2005; U.S. Department of Education, 2006). In addition, more than half of the students who are labeled for special education fall under the category of Specific Learning Disabilities (SLD). And although most students are labeled Specific Learning Disabilities (SLD) in reading, approximately 20% of students are labeled SLD in mathematics or in both mathematics and reading (Borgioli, 2008; Hehir, 2005). Furthermore, a number of investigations of state assessment data have shown that (a) students in special education are rated as proficient at different rates across states, and (b) achievement gaps between students with disabilities and students without disabilities vary extensively among states (Albus, Thurlow, & Bremer, 2009; Thurlow, Bremer, & Albus, 2008; VanGetson & Thurlow, 2007).

According to Wagner, Kutash, Duchnowski, and Epstein (2005), the Special Education Elementary Longitudinal Study in 2004 of 11,000 elementary and middle school students with disabilities reported that as a group, 30% of students with disabilities scored above the 50^{th} percentile in mathematics calculations, whereas 40% fell below the 25^{th} percentile on the Woodcock Johnson III (WJ3). Data were collected over a 6-year period on elementary and middle school students with disabilities whose ages ranged from 6 years to 13 years. Data collected included student outcomes in mathematics and reading achievement. These data had been documented as students in their study transitioned from elementary to middle to high school. However, at the secondary level the outcomes for students with disabilities were lower as the content became more difficult (Cortiella, 2007). In spite of these outcomes, the results of the 2007 National Assessment of Education Progress (NAEP) indicate that this group of students is advancing in academic performance at a much faster rate than students without disabilities (Cortiella, 2007).

Inclusive Education for Students with Disabilities

Historically, inclusion has been defined in different ways. One has been to place 100% of students with disabilities in age-appropriate general education class settings and communities on a full time basis (Berry, 2006; Ryndak, Jackson, & Billingsley, 2000). Another is to offer a range of learning opportunities at different levels (Ryndak et al., 2000) for students with disabilities to have access to education in regular classrooms (Artiles & Kosleski, 2007; McLaughlin & Jordan, 2005; Waitoller & Artiles, 2013).

Historical Background of Inclusive Education

Prior to 1975, students with disabilities were educated mainly in segregated facilities in which special education was centered around the "dilemma of difference" (Ben-Porath, 2012, p. 26). The global movement for inclusion, however, came about in response not only to the exclusion of students with disabilities, but also to the exclusion of minority students and students of low socioeconomic backgrounds (Waitoller & Artiles, 2013).

The current focus on inclusion, which continues to oppose segregating students with disabilities in special education classrooms, is to help all students (students with and without disabilities) learn to live, work and play together so that eventually they can live successfully, work, and be together in the community as adults (Causton-Theoharis, 2009). For students with disabilities, therefore, inclusive schooling should promote intellectual growth, independence, and interaction with peers (Causton-Theoharis, 2009). This reasoning led to the inclusion of children with disabilities in public education, which in turn required shifts in policies regulating the allocation of resources, shifts in pedagogical approaches and teacher training, as well as other dimensions (e.g., special educators needing to obtain certification in content areas) of public schooling (Ben-Porath, 2012).

The Individuals with Disabilities Education Improvement Act of 2004 (IDEA), originating in 1975, aimed to provide moral and legal grounding as well as clear policies reflecting the vision that all children receive appropriate education in an inclusive environment, thereby providing equal educational opportunities to all students (Ben-Porath, 2012). In addition, because IDEA governs the services provided to students with disabilities, school districts are required to follow established procedures to identify and evaluate students who are suspected of having a disability (Bureau of Exceptional Education and Student Services [BEESS], 2010). An Individual Education Plan (IEP) team documents the student's needs, including the need for accommodations to support his or her learning (BEESS, 2010).

Essentially, "Inclusion is a way of thinking – a deeply held belief that all children, regardless of ability or disability, are valued members of the school and classroom community" (Causton-Theoharis, 2009, p. 37). Inclusive classrooms are places where all students are integral members of the classroom, are connected to their peers, have access to rigorous and meaningful general education curricula, and receive collaborative support to succeed. Mainstreaming, therefore, is not synonymous with the concept of inclusion. Mainstreaming has generally been used to refer to the selective placement of special education students in one or more general education classes with the assumption that a student must earn his or her opportunity to be mainstreamed by keeping up with the work assigned by the teacher to the other students in the class (Rogers, 1993).

General Education Teachers Share Responsibilities in Inclusive Education

Waitoller and Artiles (2013) suggested that inclusive education should focus not only on dismantling overlapping and complex barriers for learning and participation in schools, but should also create spaces for collaboration of professionals across disciplines and fields (e.g., education, sociology, psychology, and health care, among many others) including families, and students. Both general education and special education teachers have the shared, routine responsibility of student learning (Pugach, Blanton, & Correa, 2011) in an inclusive classroom, although the teacher of record is the general education teacher as the role of the special educator has changed drastically from providing direct instruction to facilitating and consulting (Turner, 2003) in inclusive classrooms. The general educator holds paramount importance for the successful inclusion of students with disabilities, assuming that he or she is knowledgeable about special education, about students with disabilities, and about how best to teach these students (Hadadian & Chiang, 2007). These teachers work with special education teachers who have the ability to model and facilitate instruction to meet the needs of students, have the ability to accurately assess student progress and analyze teaching styles, work well with a wide range of students, and have a vested interest in content (Rice, Drame, Owens, & Frattura, 2007).

According to Carter, Prater, Jackson, and Marchant (2009), effective collaboration between general education and special education teachers can facilitate the successful inclusion of students with disabilities in general education classes. When collaboration takes place in structured, supported environments, according to Carter et al. (2009), there are improved education outcomes for students with disabilities. Other advocates (e.g., Kloo & Zigmond, 2008) promoted co-teaching as a service-delivery model and claimed that co-teaching would ensure that students with IEPs receive whatever support is necessary for them to function successfully in general education classrooms. With special educators in the general education classroom, a wider range of instructional practices are available to all students in the general education classroom (Kloo & Zigmond, 2008). Collaboration between general education teachers and special education teachers is a critical aspect for effective inclusion of students with disabilities in the inclusive classroom (Carter et al., 2009) so that, in turn these teachers can work together to make changes in general education classes in order that more students experience success (Winn & Blanton, 2005).

Inclusive Education in Secondary Schools

The realities of the general education context for students with disabilities, nevertheless, pose several challenges, that are mainly the challenges of ensuring that students with and without disabilities benefit from the learning environment (Scanlon & Baker, 2012). At the secondary level in particular, the inclusion of students with disabilities in general education classrooms, poses more unique challenges because secondary teachers contend with large student caseloads, have minimal planning time, have varied instructional formats, and have high expectations for student proficiency (Kozik et al., 2009). To add to this, Maccini and Gagnon (2006) also found that secondary mathematics general educators reported being less likely than special educators to provide commonly recommended instructional and assessment accommodations to students with SLD, because general education teachers typically had only a few students with disabilities in their classes. In their study of instructional practices of a random sample of 179 general education secondary mathematics teachers and special education teachers, Macini and Gagnon (2006) found that there was a statistically significant difference between the instructional practices of the two groups. From their query of 14 instructional mathematics practices used by these teachers, special education teachers reported using more of these instructional practices than did general education teachers. In the same study, the researchers also noted that there was a lack of research focusing on teachers' use of empirically validated and recommended instructional practices to assist students with SLD in secondary mathematics inclusion classes.

Instructional Accommodations for Students with Learning Disabilities

By definition, accommodations are minor changes in how instruction is delivered and/or how a student with a disability participates, without substantially altering curriculum or expectations (Laprairie, Johnson, Rice, Adams, & Higgins, 2010; Scalon & Baker, 2012; Thompson, Morse, Sharpe, & Hall, 2005). Instructional accommodations support students with disabilities in accomplishing educational objectives in the general education classroom (Vallecorsa, deBettercourt, & Zigmond, 2000). In addition to this, according to Salend (2010), accommodations are instrumental in differentiating instruction and when used appropriately, according to Ketterlin-Geller and Tindal (2007), accommodations can offer students with disabilities an optimal environment in which to participate in the general education setting. As such, students with disabilities may use accommodations during instruction and assessment that may meet the individual student's needs and thereby provide access to academic content standards (BEES, 2006).

The implementation of instructional accommodations has been envisioned by policy makers as a primary means of ensuring an appropriate education (Mcleskey, Hoppey, Williamson, & Rentz, 2004; Scalon & Baker, 2012) for students with disabilities in general education classrooms (Mc Guire, Scott, & Shaw, 2006). Although, on average, students with SLD in mathematics continue to lag behind their peers without disabilities (Bittle & Young, 2012), there are some students with SLD who are performing well on state achievement tests, although proficiency scores for students with disabilities vary across states and range from 15% being scored proficient to more than 70% doing so (National Center on Educational Learning Outcomes [NCEO], 2011). Furthermore, it has also been noted that the achievement gap between students with SLD and their non-disabled peers also varies extensively among states (NCEO, 2011).

Instructional Accommodations in Mathematics

In order to successfully develop the mathematical ability of students who struggle in mathematics, teachers are required to use instructional accommodations for students labeled SLD in their classrooms when these are identified on the student's IEP. Some of these accommodations may require little or no extra teacher preparation time to be implemented (Fuchs, Fahsl, & James, 2014), although according to Rea, McLaughlin, and Walther-Thomas (2002) in a review of IEPs, the findings were that students in the inclusion program had significantly more general education accommodations (M = 14.8) on their IEPs than did the IEPs of students in the pull-out program (M = 5.6).

Numerous studies have shown that students learn mathematics better when manipulatives are part of accommodations (Fahsl, 2007; Marsh & Cooke, 1996) because mathematics lends itself to hands-on activities (Fahsl, 2007). According to Maccini and Gagnon (2006), most general education and special education teachers of secondary students with SLD in mathematics use empirically validated practices that include the use of objects for conceptual understanding. In addition to the use of manipulatives, instructional accommodations in mathematics may include peer or cross tutoring strategies, the use of cue cards, graphic organizers, mnemonics, and additional time for practice (Maccini & Gagnon, 2006). Other instructional accommodations that general and special education teachers use for students with SLD in mathematics are (a) allowing the use of calculators; (b) adjusting workloads, and (c) increasing time for activities and tests (Maccini & Gagnon, 2006). According to Fahsl (2007); however, although calculators may be wonderful tools if used appropriately, some students may need instruction on how to use calculators and therefore, it may also be necessary for teachers to use the same type of calculator while modeling instruction. Meanwhile, for some students whose problems in mathematics include organizing and transcribing problems from the board or text, these students could benefit from using standard lined paper turned vertically or enlarged graph paper (Fahsl, 2007). Other visual accommodations for instructional purposes include highlighting and using fact charts (Fahsl, 2007) in order to give directions on an assignment and to aid in memorizing facts and in processing.

The use of technology resources that support students with disabilities, apart from calculators, still lags behind, (O'Connell, Freed, & Rothberg, 2010) with an estimate that only 25% to 35 % of students with SLD are provided with assistive technology to support their instruction and learning. Muir (2007) also found that the technology available within schools often lies unused because teachers do not have access to or the necessary preparation to use technology-based curriculum resources.

Fidelity of Implementation of Accommodations

In order to support favorable outcomes for students with disabilities in public schools and to provide an appropriate education, NCLB mandates the use of scientifically-based instruction. In conjunction with the provisions of NCLB, IDEA explicitly establishes conditions for how students with disabilities should be accommodated in schools (Borgioli, 2008), by making provisions that were previously non-existent (e.g., a free and appropriate education) until there were stronger movements toward inclusion. Removing barriers should, therefore, enable an individual with a disability to more accurately demonstrate what he or she knows and can do (Thurlow & Bolt, 2001). The implementation of appropriate accommodations as an intervention, therefore, theoretically removes barriers to student performance and thereby reduces the impact of a disability (Thompson, Morse, Sharpe, & Hall, 2005).

In order to determine the effectiveness of accommodations provided to students with SLD, the fidelity of implementation (FOI) of their use can serve as a resource to inform the field of education (O'Donnell, 2008). Also, to determine and to further the knowledge of what works in the field of education, intervention studies on adherence to FOI have been used to explore the efficacy and effectiveness of instructional practices (Crawford, Carpenter, Wilson, Schmeister, & Mc Donald, 2012). Collecting fidelity data, therefore, is especially important when trying to account for any negative or ambiguous research findings that may occur (Hohmann & Shear, 2002; Mowbray, Holter, Teague, & Bybee, 2003). Fidelity data allows researchers to determine whether any unsuccessful outcomes are due to ineffective interventions or are due to failure to implement the intervention as intended (Swanson, Wanzek, Haring, Ciullo, & McCulley, 2011). Fidelity studies are receiving increased attention from funders and evaluators of research because of their potential to inform researchers' work as well as intervention choices made by practitioners (Swanson et al., 2011).

Unlike the fields of public and mental health, which have proposed and investigated dozens of fidelity indices, the field of education does not have one broadly accepted definition of implementation fidelity. When defining fidelity of implementation in education, distinctions are made between efficacy and effectiveness of studies (O'Donnell, 2008). An "efficacy of study's examination of fidelity focuses on whether a program is implemented at all (did the program get delivered?); to what degree (what was the program's quality?); and uses the answers to these questions to improve the program" (O'Donnell, 2008, p. 41). On the one hand, therefore, efficacy studies typically focus on the developmental stages and help developers to critically analyze the needed components for the innovation to succeed or fail (Borrego, Cutler, Prince, Henderson, & Froyd, 2013). On the other hand, an effectiveness study investigates the effects of an innovation when implemented by regular users in actual practice (Borrego et al., 2013). As such, according to O'Donnell (2008), effectiveness studies are more focused on interpreting evidence of the program for generalizability as well as for observing the implementation of the program in the field.

Investigation of fidelity of implementation has the potential to become a "shared tool that can provide researchers, policy makers, and practitioners the opportunity to co-create effective, efficient, relevant and durable systems and practices, resulting in positive outcomes for students" (Dumas, Lynch, Laughlin, Smith, & Prinz, 2001, p.2). In addition to this, apart from observing the implementation of any program in the field, new attention is being placed on the quality and measurement of the implementation (Dumas et al., 2001) with researchers being required to ascertain scientific integrity as to how fidelity will be measured, how often it will evaluated, and the degree of acceptable variance during a study.

Mathematics Outcomes for Students with Specific Learning Disabilities

Proponents of inclusion believe that students with disabilities, who are included in classrooms with higher expectations, have appropriate models, and true opportunities for generalization, will experience improved outcomes (Rea et al., 2002). Educators and researchers who have investigated the impact of inclusive arrangements on students' educational experiences, as well as the effectiveness of these arrangements, have reported that the benefits of inclusion for many students with disabilities, include gains in academic achievement, increased peer acceptance and richer friendship networks, higher self-esteem, avoidance of stigma attached to pull-out programs, and possible lifetime benefits (e.g., higher salaries, independent living) after leaving school (Berry, 2006; Salend & Garrick, 1999). Researchers have also found that the practice of inclusion can benefit students without disabilities as well, and that teachers' responses to inclusion were often associated with their perceptions of the availability of training, resources, and administrative support (Berry, 2006; Salend & Garrick, 1999).

Policy makers, educators, and parents often use outcomes from the Trends in International Mathematics and Science Study (TIMSS) as well as the Program for International Student Assessment (PISA) to determine the success of the United States in the global economy (Bybee & Stage, 2005). The low mathematics performance of students in the United States, however, has been receiving attention for decades as a result of these international and national assessments because their reports show that students in the United States are performing below the level of many other industrialized countries in mathematics (Baldi, Jin, Skemer, Green, & Herget, 2007). Although the mathematics performance scores for secondary students raise great concerns, the mathematics achievement scores of secondary students with disabilities also need closer attention (Maccini, Gagnon, Calvin, & Malmgren, 2008) than it is currently receiving. Despite improvements in mathematics achievement for students with disabilities, in 1996, the gap between students with disabilities and their peers was as high as 46.5%, but fell to 41% in 2007 (Maccini et al., 2008). Additionally, 66% of eighth grade students with disabilities performed below the basic level on the National Assessment of Educational Progress (NAEP) in mathematics, in contrast to 25% for students without disabilities

(Lee, Grigg, & Dion, 2007; Maccini et al., 2008). More recent data provided by the NAEP in 2014, 38% of fourth grade students with SLD were determined to have basic mathematics skills as opposed to 41% of students who were not labeled SLD. In eighth grade, however, the gap widened, as there was a 27% basic mathematics competency rate for students with SLD, as opposed to 40% for students without disabilities.

In order to improve outcome measures in mathematics, within the last two decades, a great deal of effort has been invested in improving the mathematics achievement of all students in the United States, leading to more rigorous standards for teaching and learning (Jitendra, 2013). Meanwhile, inclusive collaborative special education services have been implemented to address the achievement gap (O'Hara et al., 2014). These collaborative services include consultative support, collaborative support, co-teaching support, as well as supplemental special education support. These inclusive supports are necessary for students with SLD in general education classrooms with rigorous mathematics standards that incorporate problem-solving and reasoning skills for all learners (Maccini et al., 2008).

Theoretical Framework

The inclusion of students with learning disabilities in general education classrooms has been a controversial issue. On the one hand, those opposing the inclusion of students with disabilities in general education classrooms contend that general education is unprepared to meet the unique needs of students with disabilities and is primarily an effort to cut costs (Rea et al., 2002). On the other hand, supporters of inclusion believe that students with disabilities have the legal right to be educated with peers in age appropriate settings (Rea et al., 2002; Walther-Thomas, Korinek, McLaughlin, & Williams, 2000). Limited research exists on the academic outcomes of students with SLD in general education classes, especially at the secondary level, although students with SLD now have access to more challenging, engaging curricula because of federal performance mandates that were not previously required of them. Few research studies have focused on mathematics outcomes for students with SLD in general education classrooms (e.g., Bottge et al., 2015; Montague, Enders, & Dietz, 2011; Montague, Krawec, Enders, & Dietz 2014; Re et al., 2002). Students with disabilities are often perceived as low performers because of varied gaps between their performance and the performance of students who are not labeled disabled. However, state assessment data indicate their increased performance over time (NCEO, 2011). The increased performance of students with disabilities is greater at the elementary level than at the middle and high school levels (NCEO, 2011). In addition, along the continuum of performance, in some cases, students labeled with disabilities are outperforming students who are not so labeled on standard-based assessments (NCEO, 2011).

In order to further narrow the achievement gaps as more students with SLD continue to be included in general education classrooms, as educators, we need to investigate why more students with SLD are not experiencing more success in general education classrooms (Winn & Blanton, 2005). Students who are struggling, may need more explicit and guided instruction than students who are not struggling which may be accomplished by providing accommodations in the general education curriculum and instruction (Winn & Blanton, 2005). As students in general education mathematics classrooms continue to struggle and to perform at various levels, it is necessary to provide accommodations in the curriculum (Giesen, Cavenaugh, & McDonnall, 2012). As general educators and special educators work together in mathematics general education classrooms, it is with the expectation that the academic accommodations called for on the IEPs of students with SLD, are appropriately implemented with all teachers sharing common frameworks for viewing and accommodating differences (Winn & Blanton, 2005). It is the expectation also, that general education teachers implement more official instructional accommodations in order to meet the needs of students with SLD in their mathematics inclusion classes. As such, understanding and supporting general education teachers as they work with students with disabilities in their classrooms is essential and philosophically guided this study. Regardless of continuing controversies related to inclusion, this practice is widespread and continues to grow, thus making the general education teacher as critical to the education of students with disabilities as the special education teacher.

Purpose

In a study conducted by the National Center on Secondary Education Transition (NCSET) in 2008, although the rate at which students with SLD has been increasing, only 54 % of all students with disabilities graduated with a regular diploma while the rate of all students was 83% (Cortiella, 2011). For students with SLD, the rate was only 66% in 2008 and in 2009 the graduation rate for students with disabilities was 64%; still lower than the rate for students without disabilities (Cortiella, 2011). The 2008 national longitudinal study conducted by NCSET of special education students also found that only 32% of students with disabilities were employed after completing their high school program, and that more than one in four students with special needs never held a paying job. As students with disabilities continue to perform poorly in mathematics, there was the need to examine current instructional practices in the form of instructional accommodations that are being used by teachers in general education mathematics classrooms that are serving students with SLD. Using data to identify, monitor, and evaluate the use of instructional academic accommodations for students with SLD is necessary if educators are to determine whether those students are benefitting from the accommodations that have been developed to help them (VanSchiver & Conover, 2009).

The current study was conducted because there had been limited research exploring the relationship of the use of specific instructional accommodations and student outcomes, particularly in mathematics at the secondary level for students with SLD. Furthermore, this inquiry was conducted because according to VanSciver and Conover (2009), most research in special education academic accommodations has focused on the differential benefit of accommodations mainly in the area of testing. In addition to this, according to Ketterlin-Geller, Alonzo, Braun-Monegan, & Tyndal (2007), reliable systems are not in place to ensure that appropriate accommodations are being applied; further they questioned whether these accommodations are consistently being applied in classroom instruction and assessment (Ketterlin-Geller et al., 2007). This study, therefore, will begin to fill a gap in the research on instructional accommodations.

The published work in mathematics so far has focused mainly on race, gender, and socioeconomic status, but not on the subgroup of students who carry the label of SLD in mathematics (Borglioli, 2008). The current study was also conducted because of the limited research that exists to guide secondary general or special educators on instructional accommodations (Byrnes, 2008) for students with SLD in mathematics. The vast majority of research and policy guidance on accommodations for students with special needs concerns assessment and not on day-to-day classroom instruction (Scanlon & Baker, 2012); only a small body of literature offers insight into effective practices for instructional accommodations across three phases of the accommodation process: identification, provision and evaluation (Scanlon & Baker, 2012). In addition to this, teachers and students alike may gravitate toward certain favorite accommodations.

Problem

This study examined the fidelity of general education teachers' use of accommodations in their Algebra 1 classes with students with SLD. Further, academic outcomes in mathematics for these students were examined in relation to the implementation of accommodations assessed through the results of a teacher survey and classroom observations.

Research Questions

This study investigated the relationship between the fidelity of implementation of accommodations for students with specific learning disabilities and academic outcomes for these students in high school inclusion mathematics classes and asks the following questions:

1. What are the five most frequently used instructional accommodations that general education teachers report using in Algebra 1 inclusion classes that contain students with SLD?

2. Is there a positive relationship between (a) the frequency of implementation of selected "high incidence" accommodations for students with SLD that are employed by nine general education teachers with at least three students each with SLD and (b) mathematics achievement of these students determined by the results of an Algebra 1 unit test?

Operational Definitions

The following terms and concepts are defined below for the purposes of this study:

Accommodations

Accommodations are changes that can be made in the way the student accesses information and demonstrates performance. Accommodations make it possible for students to work around the effects of their disabilities (IDEA).

Fidelity of Implementation

Fidelity of implementation (FOI) is traditionally defined as the determination of how well an intervention is implemented in comparison with the original program design during an efficacy and/or effectiveness study (O'Donnell, 2008). For this study, FOI was be determined by whether the accommodation was implemented, and the frequency with which it was implemented, to determine the level of implementation using a rubric for each data set to be collected.

Inclusion

A student receiving education in a general education regular class setting, reflecting natural proportions and age-appropriate heterogeneous groups in a core academic and elective or special areas within the school community; a student with a disability is a valued member of the classroom and school community; the teachers and administrators support universal education and have knowledge and support available to enable them to effectively teach all children; and a student is provided access to technical assistance in best practices, instructional methods, and supports tailored to the student's needs based on current research (Florida Statute Section 1003.57).

Individual Education Plan

An individualized education plan (IEP) is a written document for a student with disabilities that is periodically reviewed and revised based on the student's needs. Each IEP includes a statement on present levels of performance and must also state how the student's disability impacts involvement/progress in the general curriculum (IDEA, 2004).

Specific Learning Disability (SLD)

A specific learning disability is a disorder in one or more of the basic learning processes involved in understanding or in using spoken or written language. Students may have significant difficulties affecting their ability to listen, speak, read, write, spell, or do mathematics (IDEA, 2004).

CHAPTER II

REVIEW OF THE LITERATURE

In this chapter the researcher provides a review of the literature on issues related to the inclusion of students with specific learning disabilities (SLD) in mathematics and their access to the general education curriculum. The results of the review indicated that most research conducted on students with SLD in mathematics focused mainly on specific instructional interventions (e.g., Barbaresi, Katusic, Colligan, Weaver, & Jacobsen, 2005; Geary, Hoard, Byrd-Craven, Nugent, & Numtee, 2007) in order to differentiate children with and without mathematics disabilities mainly in elementary grades (e.g. Re, Padron, Tressoldi, & Lucangeli, 2014). More studies on fidelity of implementation were found than on mathematics inclusion practices and accommodations for students with SLD in mathematics; however, most fidelity studies in education were focused on literacy interventions.

The first section of the literature review provides background information on difficulties students with SLD face in mathematics - algebra in high school, the comorbidity of mathematics and reading disabilities, and the difficulties students with SLD face with working memory and mathematics outcomes. The second section discusses some of the ways students with SLD in mathematics and students who struggle with mathematics are provided access to the general education curriculum. In the third section the researcher discusses the literature on fidelity of implementation.

Difficulties Students with SLD Face in Mathematics

Almost 66% of students with SLD spend at least 80% of their day in general education classrooms (Cortiella & Horowitz, 2014); however, the results of a survey conducted by NCLD in 2012 showed that 84% of the people surveyed regarded the issue of SLD in general education classrooms as a growing concern. According to Cortiella and Horowitz, two causes for concern are the lower grades that students with SLD earn and the higher rates of course failure that they experience in high school which are greater than students without disabilities. Between 7% and 23% of students with SLD fall below the average achievement level of 50% and between 12% to 26% of secondary students with SLD received average or above-average scores on mathematics and reading assessments, compared with 50% of students in the general population (Cortiella & Horowitz, 2014).

Low achievement criteria are most commonly used to identify subgroups of students with mathematics disabilities with cutoff points set at the 10th, 25th and 35th percentiles on measures of mathematics facts, computations and problem solving (Cirino, Fuchs, Elias, Powell, & Schumacher, 2015; Geary et al., 2007). The distinction between students with specific mathematics disabilities and students having difficulty doing mathematics is often made in terms of severity, by differentiating students with very low mathematics achievement scores from those closer to the average range, although the latter scores are often still below the normal range (Geary et al., 2007; Mazzocco & Kover, 2007; Murphy, Mazzocco, Hanich, & Early, 2007; Raghubar et al., 2009). Students with very low mathematics achievement scores showed consistent difficulties in doing mathematics (Geary et al., 2007; Mazzocco & Kover, 2007; Murphy et al., 2007; Raghubar et al., 2009).

According to Geary (2004), between 5% and 8% of school-aged children have some form of cognitive deficit that interferes with their ability to learn concepts or procedures in one or more mathematical domains. As such, weak mathematical skills are common among students with SLD because mathematics involves different components such as calculation, geometry, problem-solving and task requirements that vary with respect to the different components of mathematics (Re et al., 2014). In addition to foundational numeric competencies and language and reading skills, mathematics involves working memory, processing speed, visuospatial abilities and knowledge of strategies (Re et al., 2014). The inability to solve basic mathematical concepts also negatively impacts how these students solve novel concepts because of their problems with attention, memory, background knowledge, vocabulary, language processes, strategy knowledge and use; visual-spatial processing and self-regulation (Geary, 2003). Montague (2008) also shared that students with SLD in mathematics are characteristically poor strategic learners and problem solvers and have difficulty abandoning and replacing ineffective strategies. In addition to these characteristics, students with SLD in mathematics often have difficulty with attention, self-regulation and lack motivation which affects their behavior and learning (Fuchs et al., 2005; Montague, 2007).

The many components involved in doing mathematics help to engender fear of failure and anxiety in many students causing them to exhibit learned helplessness

(Lucangeli & Scruggs, 2003). Many children who struggle in mathematics, therefore, become adults who may lack the ability to reason quantitatively which ultimately affects their ability to understand time, money, direction and space (Beacham & Trott, 2005). As students with disabilities struggle to achieve in mathematics, researchers Cawley, Parmar, Fley, Salmon, and Roy (2001) noted that upper elementary and middle school students with mild disabilities often do not have highly developed mathematics vocabulary and have lower automaticity for computation. Similarly, Woodward and Montague (2002), from their research findings, suggested that students with high incidence mathematics disabilities tend to rely on more immature strategies, such as repeated addition for multiplication when learning mathematical facts.

Algebra in High School for Students with SLD

In order to prepare students for career and college readiness, high school mathematics requirements continue to rise as more states incorporate the Common Core Standards (Strickland & Maccini, 2012). Within the mathematics standards, all students in high school, including students with learning disabilities, are expected to progress through Algebra I, Geometry and Algebra II (Strickland & Maccini, 2012). Although Algebra is "the gateway to postsecondary employment and achievement" (Strickland & Maccini, p. 142), students with and without disabilities face challenges learning Algebra (Foegen, 2008), even more for students with SLD in mathematics who struggle with the abstract Algebra content because of their weak abstract-reasoning skills (Steel & Steel, 2003). When surveyed about their perceptions, students with SLD in mathematics were more likely than their peers (55% vs. 32%) to identify mathematics as their least favorite high school class (Kortering, deBettencourt, & Braziel, 2005) and these students also indicated that if they were provided more assistance, experienced different teaching styles, worked in groups, and had teachers who increased the interest level of the instruction, their performance would be improved (Kortering et al., 2005).

According to Steele and Steele (2003), teachers frequently recommend students draw pictures to help them visualize Algebra word problems, yet students with SLD who have difficulty in mathematics may encounter more problems with this strategy because they may have a visual-processing deficit. The deficit can be identified, for example, when students make errors with the number line by reversing the positive and negatives numbers or have difficulty with graphs by inaccurately labeling quadrants or inaccurately transferring mathematical information to a graph in a way that it would make sense (Steele & Steele, 2003).

Because of the difficulties students face in Algebra, Strickland and Maccini (2012) studied the effects of their instructional intervention using the Concrete-Representational-Abstract (CRA) sequence, graphic organizers and specific instruction in order to determine to what extent: (a) secondary students with SLD improve their performance on multiplying linear expressions, (b) secondary students with SLD in mathematics will maintain their performance on multiplying linear expressions, (c) will these students transfer their knowledge of multiplying algebraic expressions to novel tasks and (d) will these students find the CRA-1 strategy beneficial and enjoyable? The participants consisted of only three male students in a non-public school, two students were in the ninth grade and one in the eighth grade. Although the intervention focused mainly on multiplying linear expressions unlike other studies that focus mainly on basic Algebra concepts, the results indicated the effectiveness of the use of concrete manipulatives. According to Strickland and Maccini (2012), all the participants developed procedural fluency, procedural knowledge and maintained the content of this current study for three to six weeks after the intervention. The researchers, therefore, suggested that the content focus of this more recent study was an important "benchmark for career and college" (P. 143) and they also suggested replication of this study with a variety of Algebra concepts and using a greater number of students in order to establish external validity.

If students with SLD are to succeed in Algebra, therefore, the use of evidence-based practices for assessment and instruction must become standard practice (Foegen, 2008) because educators need effective tools for tracking student learning and for determining when instructional changes are needed. They also need proven strategies for providing supplemental instruction in Algebra when students experience difficulty (Foegen, 2008).

Comorbidity of Mathematics and Reading Disabilities

Words such as more, less, older and younger, when used in word problems, present challenges for all students with the language and formulation of concepts (Fuchs, Fuchs & Compton, 2013). In a study focused on mathematics difficulties combined with and without reading difficulties, Fuchs et al. (2013) found results that were in agreement with earlier studies concerning the prevalence of comorbidity for mathematics and reading difficulty (e.g., Badian, 1999; Barbaresi et al., 2005). Most of the studies on comorbidity showed few differences between subgroups of students with mathematics difficulties and those with both mathematics and reading difficulties determined by complex computational measures (Andersson, 2008, 2010; Barbaresi et al., 2005; Chan & Ho, 2010; Cirino, Fletcher, Ewing-Cobbs, Barnes, & Fuchs, 2007; Hanich, Jordan, Kaplan, & Dick, 2001; Jordan, Hanich, & Kaplan, 2003; Raghubar et al., 2009) with a few exceptions (Jordan & Hanich, 2000). In their study, Barbaresi et al. (2005) found that between 35% and 56% of participants did not have a comorbidity of mathematics and reading disabilities. In another study, Cirino, Fuchs, Elias, Powell, & Schumacher (2015) examined a large sample of young learners with different forms of academic difficulty in mathematics. The results of the different mathematical competencies and cognitive resources indicated that students with the comorbidity of mathematics and reading disabilities performed below the level of students with only mathematics disabilities (MD). Despite studies showing strong evidence of the comorbidity of reading and mathematics difficulties relatively few studies have systematically examined the causes or implications between these disabilities (Willcutt et al., 2013).

Working Memory. Beyond difficulties in foundational numeric competencies and language, other difficulties shown to be related to mathematics include difficulty with working memory and processing speed (e.g., Fuchs et al., 2005; Fuchs et al., 2006; Swanson & Kim, 2007). Working memory is referred to as a mental workspace, involved in controlling, regulating, and actively maintaining relevant information to accomplish complex cognitive tasks (Raghubar, Barnes & Hecht, 2010). The main processes of working memory are the preservation of information while processing the same and other information (Andersson & Lyxell, 2007). Raghbir et al. (2009) suggested that knowing whether working memory is related to how children learn and why some children have difficulty in learning mathematics may be important in designing instruction. Because the cognitive processes involved in calculation difficulties are not the same as the processes involved in problem solving difficulties, Swanson (2014) called for unique interventions but also noted that the use of strategies for students with SLD in mathematics may not always be advantageous.

In spite of a growing number of studies on the relationship between working memory and performance, comprehensive studies on working memory are few although relevant for differentiating learning disability subgroups (Cirino et al., 2015). Some studies have shown that mathematical performance is connected to working memory both in adults and children (e.g., DeStafano & LeFevre, 2004; Furst, & Hitch, 2000; Gathercole, Pickering, Knight, & Stegmann 2004b).

Recent studies have supported the teaching of cognitive strategies in order to improve the mathematical performance of children (e.g., Knolloffel, Eysink, de Jong, & Wilhelm, 2009). In order to facilitate and improve the performance of students with SLD in mathematics, cognitive strategy instruction has been designed to teach multiple cognitive and metacognitive processes (Montague, 2008; Montague, Krawec, Enders, & Dietz, 2014). In their study of 40-seventh grade general education inclusive classes in schools in the Miami-Dade County School District, Montague et al. (2014) used a research based cognitive process known as *Solve It!* to assess problem solving performance and mathematics achievement. The results of this study showed that students who received this cognitive intervention (n = 644) which was embedded in the curriculum, performed better on curriculum-based measures than students ($n = 415$) who did not receive the intervention. Montague et al. (2014) was a replication of a previous study by Montague, Enders, and Dietz (2011) on 8th-graders in general education classes in order to determine whether the positive findings of the previous study could be replicated with a different population.

Swanson (2014) sought to determine whether cognitive strategy training on word problems compensated for working memory capacity in children experiencing difficulty in mathematics. Swanson hypothesized that having ample working memory resources was a prerequisite for successful strategy training and that children with relatively small working memory capacities may become over taxed by certain strategies despite the overall benefit of strategy instruction in remediation. In an earlier study by Turley-Ames and Whitfield (2003); however, strategy training helped the lower level participants allocate working memory resources more efficiently than the higher level participants.

Working Memory, Mathematics Performance and Comorbidity. According to Andersson and Lyxell (2007), experimental and correlational research on adults and children have shown that the central executive system is critically involved in all types of mathematical tasks. In their study, they reported that students with a mathematics learning disability have a working memory deficit because of problems related to the central executive system. The central executive system is responsible for gathering information about current situations, analyzing and integrating that information and using the results to make decisions and plan actions. According to Andersson and Lyxell (2007), “Children with MD have a central executive deficit restricted to simultaneous processing and storage of numerical and verbal information, whereas children with comorbid mathematical and reading difficulties have a deficit connected to simultaneous processing and storage of numerical and visual information" (p. 224).

Although the findings of Anderson and Lyxell (2007) were consistent with some studies (e.g., Berg, 2008), other studies (e.g., Anderson & Lyxell, 2007; Passolunghi & Siegel, 2001, 2004; Swanson & Beebe-Frankenberger, 2004) suggested that children with SLD in mathematics who have a normal reading ability might have problems only with the central executive component, while children with comorbid mathematics and reading difficulties have a general working memory deficit involving all three components of Baddeley's model of working memory (central executive system, phonological loop and visuospatial sketchpad). Other studies (e.g., Passolunghi & Siegel, 2004) have sought to determine whether working memory deficits are general or specific in children with learning disabilities in mathematics. Although the researchers' aim was to examine which components of Baddley's working memory model were mainly involved in mathematics ability, their focus was not on comorbid mathematics and reading deficiencies. Because of working memory deficits therefore, students with SLD in mathematics have trouble recalling steps to complex problem solutions, have trouble recalling formulas, remembering rules for the order of operation, recalling how to solve problems with integers, remembering all the possible ways to factor a polynomial or solving a quadratic equation (Steele & Steele, 2003).

Procedural Skills. Students with disabilities in mathematics tend to use poor procedural skills and continue to rely on immature strategies, like counting on their fingers and guessing to assist working memory (Geary, Hoard, Byrd-Craven, & Desoto, 2004). Poor memory capabilities may result in problems retrieving basic facts according to their study of first-, third- and fifth-graders with and without SLD. Geary et al. (2004) found that although first-graders with SLD relied more heavily on finger counting than their peers without disabilities when solving simple problems, the inverse was discovered when they solved more complex problems indicating that a factor other than working memory related to the greater use of finger counting to solve complex problems. When solving more complex problems, Geary et al. (2004) noted that first-graders with SLD in mathematics relied more on retrieval and guessing and made a higher percentage of errors than their non-disabled peers who relied more on finger counting. It was also noted that students without SLD in mathematics from first-grade, third-grade and fifth-grade relied not only on finger counting but also on verbal counting and decomposing when solving complex problems. As a result of using these additional strategies, students without disabilities were able to solve complex problems with greater accuracy more than their disabled peers.

Many students with mathematics disabilities, therefore, have reading disabilities, working memory disabilities, trouble with instruction or problems presented in written form along with auditory-processing or motor-processing problems which may cause them to have trouble interpreting what they hear, or have difficulty creating accurate drawings to represent word problems. As such, they may have trouble understanding lectures and oral directions including oral directions that go with manipulatives. In addition, students with a motor-processing problem may have trouble creating drawings to represent word problems and even coping with a long problem can pose a problem making the task more difficult and further hindering their understanding of an Algebra concept (Steele & Steele, 2003).

These deficiencies, however, can be overcome if students are tested for the disability and practical instructional designs are incorporated into classrooms (Michaelson, 2007). Teaching pedagogies, however, may be insufficient to meet the learning needs of students with SLD and other struggling learners (Griffin, League, Griffin, & Bae, 2013) although many have argued that rigorous, reform-based standards of instruction can lead to better learning outcomes for diverse groups of students.

Mathematics Outcomes of Students with SLD

An area of importance to the inclusion movement has been the collection and use of data to document the progress of students with disabilities in the general education classroom (Zumeta, 2015), but despite the attention paid to assessment and accountability, the achievement of students with disabilities on state assessments has remained persistently low. According to Zumeta (2015), in mathematics, only 18% of students with disabilities met or exceeded proficiency at the fourth grade level and only 10% in the eighth grade; 91% of 8^{th}- graders and as high as 94% of 12^{th}–graders scored below the proficiency level.

In mathematics, the bulk of the research in progress monitoring has been conducted in the elementary grades (Foegen, Jiban, & Deno, 2007). In an effort to improve the outcomes for students with SLD in high school mathematics, however, Strickland and Maccini (2012) implemented the Concrete-Abstract-Representational Integration strategy (CRA-I) in a ninth grade Algebra I general education class with three students. The intervention included the use of concrete manipulatives, manipulative sketches, graphic organizers and explicit instruction with teacher modeling and think-alouds. Students were tested at the end of each lesson in order to meet the 80% criterion to move to the next lesson (Strickland & Maccini, 2012). Only three male students with SLD in mathematics who had the same mathematics teacher were used in Strickland and Maccini (2012). The implementation of the intervention was staggered because each participant had to demonstrate a level of stability and trend on baseline probes prior to the intervention. The results of the study indicated all three participants experienced a substantial increase in their overall accuracy from baseline to intervention, that these secondary students with SLD learned to multiply linear expressions to form a quadratic expression when they were provided with the CRA-I strategy and they developed a conceptual understanding of the generalizability of a quadratic expression. Three to six weeks after the intervention, two out of the three participants demonstrated maintenance on the probes (Strickland & Maccini, 2012). Although the outcomes for this study were favorable for these three secondary students who had a history of difficulty in algebra, future study with a larger sample and a variety of algebra concepts need to be implemented in order to develop external validity.

In order to determine the outcomes of the instructional practice, *Solve It!* which is a researched based instructional mathematics program used in general education inclusive middle school classes, Montague et al. (2011) selected 40 middle schools in a large urban school district for their investigation. The researchers implemented the intervention, *Solve It!* and sought to determine student outcomes on curriculum-based measures (CBM), differential effects on the students with varying disability levels, and the effects of the intervention on the Florida Comprehensive Assessment Test (FCAT) scores. Although *Solve It!* was initially designed to accommodate students with SLD in the general education classroom, students labeled low achievers (LA) and average achievers (AA) in mathematics were also included in the experimental group receiving the intervention. On one hand, the results of the intervention indicated overall improvement on the CBM's for all students including low achieving students and students with SLD. On the other hand, the results of the FCAT data were less favorable for students with SLD who scored consistently lower than students labeled LA and AA.

Providing Access to the General Education Curriculum

In spite of personal characteristics, backgrounds or physical challenges, all students should have access to a curriculum that is challenging, (National Council of Teachers of Mathematics, [NCTM], 2000). Minimal research on the academic achievement of students with SLD in mathematics is available as there is a limited number of researchers who investigate academic interventions to accommodate secondary students with SLD in mathematics (Bottge et al., 2015). Moreover, according to Griffin et al. (2013), researchers typically design and conduct studies to evaluate the effectiveness of instructional practices on children's learning, but give less attention to how their teachers understand, design, and deliver instruction. Yet, according to Cirino et al. (2015), the main purpose of clarifying the competencies among learning disability subgroups is to inform interventions.

Interventions that Facilitate Access to Mathematics in General Education Curriculum

Effective instruction can improve students' achievement in reading and mathematics, but findings from value-added studies have yet to reveal exactly what teachers do to facilitate student achievement (Griffin, League, Griffin, & Bae Griffin, 2013). In their study of students with mathematics difficulties, Griffin et al. (2013) reported that different interventions are needed for each subgroup and suggested screening for each subgroup in order to deliver interventions in different ways pending further studies on word problems and number combinations. In another study to determine the efficacy of specific, individualized training of 54 students with different levels of mathematics difficulties, Re et al. (2014) found that specific individualized training was beneficial to students in the experimental group, including students with more severe mathematics disabilities. As a result of their findings, Re et al. concluded that specific training to each child's cognitive profile is a better solution for effective training purposes unlike other similar studies that focused specific training on groups of students with mathematics disabilities (e.g., Fuchs et al., 2005; Fuchs et al., 2010; Fuchs, Fuchs & Compton, 2012; Montague et al., 2011).

Observational instruments of mathematical teaching that assess the teaching of students with disabilities in general education classes are rare (Griffin et al., 2013). There are more observational systems used in reading classrooms that capture student-teacher reactions, gauge responsiveness of instruction to student needs and may show promise for measuring instruction to students with SLD in general education mathematics classes. The data generated may offer insights into how teachers differentiate instruction and provide support depending upon the learning needs of students (Griffin et al., 2013).

In the review of the literature, most of the research on teacher practices and interventions have been conducted at the elementary level, yet they help to support the teacher as the most important variable in education. Griffin et al. (2013) in their study involving two elementary mathematics teachers in inclusive elementary classes found that the students with SLD performed better with explicit instruction and teaching practices that included the use of manipulatives and other visuals. The researchers also suggested the need for future research with a larger sample focused on examining the relationship between classroom observation data of teacher practice and student outcomes in mathematics (Griffin et al., 2013). Kane and Stainger (2012), agreed that "no single measure can provide all the information needed to appropriately and accurately assess teachers' instructional practices" (p.18).

Instructional Practices and Accommodations

According to Scanlon and Baker (2012), instructional accommodations support students with disabilities in accomplishing educational objectives in their general education classes. In a study conducted on both secondary general and special mathematics educators, Maccini and Gagnon (2006) not only reported data on the types of instructional practices used with students labeled SLD and Emotional Behavior Disability (EBD), but in their summary of instructional implications, these researchers questioned who should teach mathematics to students with SLD and EBD. Maccini and Gagnon (2006) raised the question as a result of researcher findings, as they initially sought to determine mathematics instructional practices by teacher category (secondary general educator and special educator) using a nationwide mass-mailed survey.

From Maccini and Gagnon's (2006) initial mailing of 750 surveys to public secondary level teachers, 278 special and 215 general education teachers responded. Among those who responded, there were only 101 special education inclusion teachers who taught mathematics, and only 78 general education mathematics teachers who indicated that they taught inclusion classes. Subsequently, a sample population of only 176 general and special educators across the United States who taught mathematics to students with SLD and EBD in inclusive classes were used in the study as the researchers reported that they lost three participants. Of the 176 remaining teachers that responded to the questionnaire, 44% (n = 78) were general education teachers and 56% (n = 98) were special education teachers. Furthermore, 69% (n = 122) of the overall respondents were female, mostly special education teachers 57% (n = 69). The majority of respondents reported that they were 40 years of age or older 72% (n = 126) and 61% (n = 105) held graduate degrees (Maccini & Gagnon, 2006). There were no significant differences that were determined among the general and special educators with regard to gender, age, or educational level. Two groups of teachers were drawn from a sample of teachers responsible for teaching students in collaborative inclusion settings.

In this nationwide study, Maccini and Gagnon (2006) first sought to determine what specific instructional practices their sample population of teachers reportedly used during instruction on basic mathematics computation skills and problem-solving tasks. Their second question dealt with what specific accommodations these teachers reportedly used when assessing these students with disabilities in their classrooms. The third research question addressed factors that predict the number of instructional practices, and assessment accommodations general and special educators reportedly made for students with SLD and EBD. Predictor factors included: (a) years teaching students with SLD and/or EBD (b) the number of methods courses completed by each teacher, and (c) knowledge of mathematics topics. Knowledge of mathematics included topics such as pre-algebra, algebra, geometry, general or basic skills mathematics, algebra II, and algebra Il/trigonometry, statistics/probability (Maccini & Gagnon, 2006).

From the findings on their first research question which is relevant to this current research project, Maccini and Gagnon (2006) reported that the mean number of instructional practices on basic mathematics skills/computational tasks was 9.13 (*SD* = 2.86) for special educators and 6.17 (*SD* = 2.89) for general education teachers. Furthermore, on multistep problem solving tasks, the researchers reported a mean number of 8.46 (*SD* = 3.08) for special educators and 9.09 (*SD* = 2.57) for general education teachers. A statistically significant difference existed between the two groups of teachers on the average number of instructional practices used with basic mathematics skills. Special educators, therefore, were more likely to report that they used accommodations such as individualized instruction, additional practice, reduced classwork problems, and extended-time on assignments. Special educators also reported reading to students, using classroom aides, cue cards of strategy steps, calculators, giving individualized attention, and using graphic organizers. Further analysis of the data revealed that there were no statistically significant differences between special and general educators on the overall use of 14 procedures used with problem-solving tasks. For problem-solving tasks, special education teachers reported using basically their same strategies as they do for solving basic/computational skills, whereas general education teachers reported using calculators, giving their individualized attention to their students with disabilities, allowing extended time on assignments, as well as using peer and cross age tutoring (Maccini & Gagnon, 2006).

For their third research question which is also relevant to this research paper, Maccini and Gagnon (2006) analyzed their predictor variables for both special and general education teachers. These predictor variables included: (a) years teaching students with SLD and/or EBD, (b) the number of methods courses completed by each teacher, and (c) knowledge of mathematics topics. Their analysis of the data for special education teachers on these three predictor variables indicated that these variables accounted for 11.7% of the variance in the total number of instructional practices special education teachers noted using with students with SLD and/or EBD on basic mathematical/computational skills and problem-solving tasks. For the two other predictor variables (knowledge of mathematics topics and number of methods courses taken), knowledge of mathematics topics contributed significantly to the prediction of instructional practices above and beyond the other predictor variables, as knowledge of mathematics topics accounted for 6.1% of the total variance after the other variables were controlled. On the other hand, for general education teachers, the same three predictor variables accounted for 12.5% of the variance in the total number of instructional practices that they reported using with students with SLD and/or EBD on basic mathematics/computational skills and problem-solving tasks (Maccini & Gagnon, 2006). Also, for general education teachers, the number of methods courses accounted for 9.6%

of the variance when the other variables were held constant. General education teachers were more familiar than were special education teachers with the topics of pre-algebra, algebra, geometry, algebra II, algebra Il/trigonometry, statistics/probability, and integrated/unified high school mathematics (Mancini & Gagnon, 2006).

In a study conducted by Conover (2009) of 12 middle and high school teachers in a rural district in Delaware, this researcher documented academic accommodations performed as part of a dissertation by a doctoral student at Wilmington University. The 12 teachers were special education inclusion teachers, and each of these teachers was given a caseload of three special education students. Each teacher maintained a checklist of accommodations or interventions given to their three special education students on their caseload. Data collection on the use of accommodations and interventions was carried out for approximately one-half of a grading period, four-and-a half weeks. A checklist with two columns, one side of which accommodations used were tallied, and the checklist on the other side was used by the teacher to record the effectiveness of the accommodation. At the end of the project, the final focus group session consisted of 11 of the initial 12 special education teachers whose responses, upon analysis, showed that the teachers recognized the benefit of keeping a consistent record of the interventions they do with their students. At the focus session, the group shared which accommodations "worked" and the accommodations that did not "work" for their students at all, producing a consensus of having a consistent record of accommodations made in the classroom. In this study the teachers self-reported their implementation of accommodations and the student outcomes. However, observations of implementation are more valid than self-report or questionnaires which require the implementer to objectively remember and report on their implementation (Swanson, Wanzek, Haring, Ciullo, & McCulley, 2011).

Examples of Specific Accommodations

Some examples of accommodations used in classrooms include, calculators, visuals such as graphic organizers, concrete materials and manipulatives and technology. Calculation devices are used by students whose disabilities affect mathematics calculation in order to access the curriculum, but may not be used when given a task that involves mathematics reasoning (BEESS, 2010). The National Council of Teachers of Mathematics (NCTM, 2000) has supported the use of technology, such as calculators for the teaching and learning of mathematics by all students especially for students with disabilities in order to improve learning (Bouck, Joshi, & Johnson, 2013). Maccini & Gagnon (2000) reported that calculators were the most widely used accommodation for students with disabilities and, therefore, are the most commonly used accommodation on IEPs (Kauffman, McGee, & Bridgham, 2004; Lazarus, Thompson, & Thurlow, 2006; Tindal & Ketterlin-Geller, 2004; Thurlow, Lazarus, Thompson, & Morse, 2005) yet, research and literature are limited on the use of calculators by students with disabilities (Maccini & Gagnon, 2005).

The available literature on the use of calculators by students with disabilities; however, is at odds with the use of calculators as an accommodation for students with disabilities in mathematics classrooms and on state assessments (Maccini & Gagnon, 2005; Thurlow et al., 2005). The ongoing debate has resulted in both negative and positive opinions. Among the negative opinions on the use of calculators in the mathematics classroom is that calculators will prevent students from learning basic facts and from developing computational fluency (Bouck et al., 2013; Rapp, 2005). This ideology therefore, contributes to the notion that students with disabilities need to master their basic mathematics skills and that the use of calculators can become a crutch, limiting their skill development (Bouck et al., 2013). Proponents of the use of calculators in the classroom, however, have argued that "calculators can free the cognitive resources of students with disabilities for problem solving as opposed to students being consumed with trying to recall basic facts or performing computational fluency" (Steele, 2007, p. 371).

Visual representations of mathematical relationships are another accommodation that has been consistently recommended in the literature for mathematics instruction (e.g., Gersten et al., 2009; National Research Council [NRC], 2001; Witzel, Mercer, & Miller, 2003). The NRC (2001) report stated that "mathematical ideas are essentially metaphorical" (p. 95). "Mathematics requires representations. . . . Representations serve as tools for mathematical communication, thought, and calculation, allowing personal mathematical ideas to be externalized, shared and preserved. They help clarify ideas in ways that support reasoning and building understanding" (p. 94). Visuals such as graphic organizers have been used successfully throughout the years (Boon, Fore, & Spencer, 2007) as an accommodation, and students with and without disabilities have been shown to benefit from using graphic organizers (GOs) because they are helpful in organizing and recalling information (DiCecco & Gleason, 2002). Graphic organizers have been used to practice equations and to outline real processes that students have difficulty visualizing (Zollman, 2009). In a study conducted by Zollman on 240 students in Grades

3 to 5, the results showed positive results using GOs instead of the conventional method using paper and pencil indicated by pre-test and post-test results. The post-test results showed a 44% increase after modified graphic organizers were used by the students to solve open response mathematical questions. Graphic organizers are nonlinguistic, visual displays that combine the linguistic mode of key words or phrases with arrows and symbols to highlight connections and relationships (Barton-Artwood & Little, 2013).

Additional visuals such as concrete materials include measurement tools, physical manipulatives and pictorial representations which are widely accepted for engaging young children in complex mathematics because they can provide a bridge between children's intuitions, prior experiences, and complex mathematics (Vitale, Black & Swart, 2014). In their study of 80 elementary students in a large city, however, Vitale et al., 2014 found that although the visuospatial properties of concrete learning materials may provide an intuitive foothold for grounding concepts, these properties may unintentionally interfere with learning by reducing desirable difficulties. The Common Core State Standards emphasize that concrete models are essential for learning mathematics across all grade levels from Kindergarten to 12th grade as is specified in the Standard for Mathematical Practice 5 emphasizing the use of appropriate tools that allow students to choose concrete models (including manipulatives) and technology (National Council of Supervisors of Mathematics [NCSM], 2013). In agreement with the findings of Vitale et al. (2014), the standards suggest using models in initial steps of learning mathematics. For students with SLD, however, at the secondary level, according to Witzel, Ricomini and Schneider (2008), one effective way to improve the mathematics performance of students is through a sequence from concrete-to-representational-to-abstract (CRA). There are three levels of the CRA with (a) the concrete learning using hands-on instruction by way of manipulatives, (b) representational learning through pictures, and (c) abstract learning through symbols (Witzel et al., 2008). Even when concrete manipulatives are available, however, virtual ones add value by integrating pictorial, verbal, and symbolic representations while allowing students to move objects in the same way they would move concrete manipulatives (Moyer-Packenham, Salkind, & Bolyard, 2008).

Fidelity of Implementation

Well planned research methods can easily become distorted when moved into the reality of classroom implementation (Crawford et al. 2012). Well established educational researchers acknowledge the challenge of creating and implementing sound research studies within school settings (Gersten et al., 2005). Although researchers are striving to meet standards for internal and external validity, they are not questioning the influence of different standards within the context of unique studies with diverse populations (Crawford et al., 2012). Fidelity of implementation, however, is one measure of internal validity that is a "multilevel, multivariate phenomenon affected by personal, programmatic and contextual factors" (Zvoch, 2009, p. 46). A threat to internal validity is weak implementation fidelity, a factor that has the potential to provide alternate explanations for observed effects (Crawford et al., 2012).

Fidelity data are especially important when trying to account for otherwise negative or ambiguous findings. In order for educators and other researchers to adequately interpret the results of intervention research, there must be precise collection and reporting of fidelity data (Gersten et al., 2005). More precise fidelity scores may be obtained by examining the quality of instruction in addition to examining the number of occurrences or components of the intervention that are implemented (Gersten et al., 2005). In recent years, efforts have been made to estimate the main effect relationships between treatment delivery indices and recipient outcomes (Durlack & DuPre, 2008; O'Donnell, 2008; Zvoch, Letourneau, & Parker, 2007). In the field of education, O'Donnell (2008) reported that measuring the relationship between fidelity implementation and achievement outcomes have revealed data that has led to statistically significant higher outcomes.

Although the purpose of fidelity of implementation research is to better operationalize and measure implementation criteria in practice during intervention studies (O'Donnell, 2008), there are no universal data collection tools that can be applied across a wide variety of implementation studies. According to Zvoch (2012), in order to estimate the measures of relationships between multidimensional fidelity constructs and the outcomes of the individuals of interest, complex statistical models are often necessary. Keller-Margulis (2012) stated that fidelity can be measured using direct and indirect measures because it is more feasible to use multiple measures. According to Keller-Margulis (2012), there are three methods of measuring fidelity: (a) observations, (b) self-assessment and (c) analysis of permanent products.

Swanson et al. (2011) conducted a study on journals reporting fidelity research (n = 50), 88% (n = 44) of which they reported using some type of classroom observation. Swanson et al. (2011) reported that observation was the most common form of data collection in most intervention studies that involved mathematics only, whether live, by audio or by video. According to Swanson et al. (2011), the authors of these studies did not offer specific guidelines for the number and frequency of data collection, yet observations can provide precise estimates of intervention implementation and may be more reliable than self-reporting (Swanson et al., 2011). Swanson et al. (2011) also suggested that researchers collect fidelity data over the course of the study on a regular basis.

Self-assessment is another method of collecting fidelity data by way of surveys, questionnaires, logs, or checklists (O'Donnell, 2008). Apart from being an inexpensive method of data collection, according to Carroll et al. (2007), self-reporting is the most common means of evaluating the responsiveness of all participants to an intervention. This assessment can involve several perspectives and may evaluate how far participants fully accept the responsibilities required by an intervention and how far they perceive the intervention to be useful.

The analysis of permanent products, the third method of measuring fidelity, is the examination of work done by participants during the intervention. In the literature, there were several studies indicating differences in how permanent product data were sampled for analyses. In some of these studies, there were days when no permanent products were considered ‘‘0 % adherence’’ (e.g., Noell et al., 2005; Sanetti, Fallon, & Collier-MeeK et al., 2013 b); however, in other studies (e.g., Sheridan, Swange-Gagne, Welch, Kwon, & Garbacz, 2009; Swanger-Gagne, Garbacz, & Sheridan, 2009), there were intervention days that have no completed permanent products included in their analyses.

There are some drawbacks with each of these forms of measurement, however. For example, observation can be the most expensive form of collecting fidelity data because it may require the use of additional personnel to attend intervention sessions and may involve time-consuming coding of data. Self-assessments are sometimes inaccurate and the use of permanent products may not always be appropriate for measuring fidelity when a subjective quality is required (Sheridan et al., 2009).

Much of the research surrounding implementation fidelity in education settings also has involved teacher-led instruction (e.g., Crawford et al., 2012, & Zvoch, 2009) in order to explore the efficacy and effectiveness of instructional practices. In their study of 11 public middle schools in seven states, Crawford and Carpenter proposed teacher adherence to the delivery of the program as one of their independent variables. Three formal and informal teacher observations were used to rate teachers. Post-test outcomes were the dependent variables and the results of their research showed a positive relationship between teacher adherence to the structure of the HELP mathematics program and student performance. Although the intervention in their study was computer-based, Crawford and Carpenter concluded that teacher fidelity to implementation (e.g., continuously monitoring, redirecting students and individually instructing students) was just as important as in teacher-led instruction.

Crawford et al. (2012) defined two major constructs of fidelity: (a) fidelity to structure and (b) fidelity to process. The researchers described fidelity to structure as the total time in intervention, concentration of time in the intervention, and teacher adherence to and student engagement with the program. Fidelity to process, however, is defined by the way providers (teachers) implement interventions such as: (a) teacher motivation, (b) teacher preparation and (c) teacher experience (Zvoch, 2009). From these constructs, Zvoch studied program implementation in 99 kindergarten classrooms in 42 schools and although the focus of the study was on teacher-led implementation of the program, the researcher also focused on whether the various aspects of the program were implemented or not implemented without focusing on student outcomes. Zvoch's findings did not fully agreed with those of Crawford et al. (2012) that teacher motivation, preparation and experience, as well as time and classroom management accounted for differences in how providers implement interventions. Zvoch (2009) found that along with the background characteristics of teachers (e.g., training, experience and qualifications), contextual factors in the treatment environment (e.g., class size) were also relevant to the fidelity with which teachers implemented a program.

Challenges to fidelity of implementation of interventions were also found to exist across multiple sites (Zvoch et al., 2007). In their multi-level multi-site study, the researchers found that one such challenge was the lack of opportunity to examine within-school classroom-to-classroom differences in implementing fidelity and recipient outcomes since only one classroom in more than 40% of the schools was the focus of the study. As such, there was separation of the provider, the recipient and the site-level variance allowed the researchers a clearer understanding of outcome variation in order to estimate within and between levels among the key components of fidelity and treatment outcomes (Zvoch, 2012). When all sites were included in their analysis of treatment outcomes, contrary to their expectation, the researchers found that increased fidelity to the program model was not associated with improved literacy growth and that several low-implementing sites had some of the highest literacy growth rates observed in the evaluation.

Fidelity, therefore, has the potential to inform researchers' work and to inform practitioners' intervention choices and it is receiving increased attention from funders and evaluators of research (Swanson et al., 2011). In addition to its importance as a research method, fidelity data collection has been validated by the National Institute of Child Health and Human Development (NICHHD) which expects researchers to attend to issues of fidelity measurement by strongly encouraging a broader examination and measurement of instructional context to document and inform their understanding of fidelity of implementation (Swanson et al., 2011). For the purpose of the current study, the researcher focused on teacher adherence to implementation by observing how frequent the accommodations were implemented since the researcher attended to components that were of interest to the present study (Azano et al., 2011).

Tying It Together

The review of the literature showed that there were limited studies related to accommodations and mathematics outcomes for students with disabilities in high school general education classrooms. Although some studies revealed that specific interventions have been implemented with students struggling in mathematics, few focused on high school mathematics classes. The researcher found that most of the studies on students with disabilities focused mainly on literacy and other areas at the elementary level. The literature reviewed focused mainly on three broad issues -- the difficulties faced by these students with SLD in mathematics, interventions that provide students with SLD in mathematics access to the curriculum as well as defining and establishing the relevance for studying the fidelity of implementation of an intervention.

Studies on comorbidity of mathematics and reading disabilities as well as working memory as causes of mathematical difficulties became apparent in the literature during data base searches on "difficulty in mathematics, mathematics learning difficulties, mathematics difficulties and mathematics learning disabilities." From the results of the studies found, the researcher conducted searches on what has been done to accommodate students with difficulties in mathematics in general education classrooms using phrases such as "accommodations, mathematics accommodations, accommodating student with difficulty in mathematics, mathematics interventions, mathematics inclusion accommodations and inclusion in mathematics." Few studies were found on mathematics accommodations in the high school general education classroom.

The studies that were found indicated that there was a relatively significant portion of school-aged children experiencing difficulties in mathematics resulting in different levels of achievement. In order to determine what may be causes for the varied levels of mathematics achievement for students with disabilities, data bases were searched to determine whether the level of the implementation of intervention resulted in varying outcomes on mathematics achievement tests. Several studies on the fidelity of implementation of interventions were readily accessible from using the phrases, "fidelity implementation and fidelity of implementation." Most of the studies found on fidelity of implementation were studies related to the health field; however, there were a few studies, including recent studies, in the field of education on fidelity of implementation which were relevant to the present study and focused on what works to improve the outcomes for students with disabilities in the general education classroom.

CHAPTER III

METHODS

This chapter describes the methods that were used in this study to examine the fidelity of general education teachers' use of instructional accommodations in their general education Algebra 1 classes that served students with specific learning disabilities (SLD) in mathematics. First, the research questions will be revisited, followed by the research design, the stages of the study, a description of the setting and participants, data collection tools and data analyses. This chapter concludes with a summary.

Research Questions

Although the academic performance of students with disabilities is often thought to be persistently low, students with disabilities are performing at varied levels on state assessments, from the highest to the lowest levels (NCEO, 2011). Instructional accommodations are included in IEPs for students with disabilities with the expectation that teachers will use them routinely and their use will contribute to student achievement. However, there has been limited research to explore the relationship of the use of specific instructional accommodations and student outcomes, particularly in mathematics at the secondary level for students with disabilities. For the purpose of this research, instructional accommodations used by general education mathematics teachers were observed, and the achievement levels of their students with SLD – assessed by pre-and post-tests -- were analyzed to determine whether there was a relationship between fidelity of implementation of accommodations and student achievement in mathematics.

The following were the research questions:

1. What are the five most frequently used instructional accommodations that general education teachers report using in Algebra1 inclusion classes that contain students with SLD?

2. Is there a positive relationship between (a) the implementation score of selected "high incidence" accommodations for students with SLD that are employed by general education teachers and (b) mathematics achievement of these students determined by the results of an Algebra 1 unit test?

Hypothesis. There is a positive relationship between teacher implementation scores of selected "high incidence" accommodations for students with SLD that are employed by general education teachers and mathematics achievement determined by the results of an Algebra 1 unit test.

Research Design

This study was an ex post facto study since causation was not inferred (Newman & Newman, 1994; Newman, Newman, Brown, & McNeely, 2006). The predictor variables, student accommodations, already existed and as such, with ex post facto research, the researcher did not have the ability to randomly assign or manipulate the predictor variable (Newman & Newman, 1994; Newman et al., 2006), yet this design has the potential for better external validity. This research explored the relationship between teacher implementation of accommodations (the predictor variables) used and student post-tests scores (the criterion variable). Ex post facto research was also appropriate for this study because only the most frequently used accommodations by general education mathematics teachers were identified from among a larger set of accommodations. According to Newman and Newman (1994), one of the most effective ways of using ex post facto research is in identifying a small set of variables from a large set of variables which when related to the dependent variable can be used for future experimental manipulation. In this descriptive research study, data were gathered on teacher fidelity implementing mathematics instructional accommodations for students with SLD and were analyzed to determine whether there was a positive relationship between instructional accommodations used with fidelity and student achievement. Teachers did not receive training on the implementation of accommodations.

Predictor and Criterion Variables

The study assessed the implementation of the five most frequently used instructional accommodations reported by general education teachers with students with SLD in mathematics. In spite of my extensive review of the literature on instructional accommodations, the researcher was unable to identify reliable systems that were in place to determine whether accommodations were appropriately administered and evaluated by general education teachers. Ketterlin-Geller et al. (2007) also posed the question on how policy makers, educators, and parents knew whether these accommodations were consistently applied to classroom instruction and assessment. Moreover, Kettler-Geller et al. (2007) noted that inconsistent or inappropriate identification of accommodations for students can distract from, or even hinder, students' academic success.

Instructional accommodations were the predictor variables in the current study. First, mathematics instructional accommodations were selected from the Miami-Dade County Public Schools (MDCPS) recommended accommodations list on the district's pacing guide. These recommended instructional accommodations for students with SLD were provided on the MDCPS quarterly sections of the annual pacing guides, and, although 24 itemized mathematics accommodations were provided, only 15 of these accommodations pertained specifically to the instructional needs of students labeled SLD. These 15 accommodations were organized into a Qualtrics questionnaire (Appendix A) that was sent to 185 general education mathematics teachers in MDCPS. The survey was used for two purposes: to survey general education teachers on their use of mathematics instructional accommodations in their classes with students with SLD in mathematics and to select teacher participants dependent up their responses. Subsequently, the teacher observation checklist was prepared from data collected from the survey.

On the survey questionnaire, therefore, 15 items were presented under four main accommodation categories. Next, the five most frequently checked instructional accommodations by responders to the survey became the variables used on the teacher observation instrument. Observational data were collected using a checklist and these data were used in determining teacher fidelity. For this study, only teacher observations were used because most of the research on Fidelity of Implementation in education has focused on teacher-led instruction (Crawford et al., 2012).

The criterion variable was the change (difference) in students' scores on an Algebra I unit post-test while controlling for the pre-test scores. Pre-test scores were obtained prior to beginning teacher observations and prior to the teaching of the unit. The timing of the teaching of the unit on linear functions, equations and inequalities was pre-determined by the MDCPS Algebra I pacing guide and coincided with the period of the researcher's in-class observations. Post-test scores were collected using the same Algebra I unit pre-test after the unit was taught and within at least one week after in-class observation data were collected.

Phases of the Study

The four phases of this study were instrument development, teacher selection, teacher observation and testing, and clarifying and reviewing. Table 1 provides a breakdown of the phases of the study.

Table 1

Phases of the Research

Phase	Activity	Description
(1) Instrument Development	Distributed questionnaire	Copies of the survey were emailed to 185 mathematics teachers in the district with a return of 9 ≥ meeting criteria.
	Data analyzed	Identified the most frequently used accommodations. Used data identified to develop observation checklist.
(2) Teacher Selection	Identified teachers meeting research criteria	Teachers with ≥ 3 students with SLD in mathematics in their Algebra I classes sharing frequently used accommodations were selected for the study.

	Met with selected teachers	Scheduled and met with selected teachers to discuss study, defining interpretation of accommodations, class schedules, time lines, testing and observation protocol.
(3) In-Class Observations and Testing	Pre-tested, observed and post-tested	Peer observer training was conducted. Administered of Algebra I unit test to collect student baseline data. In-class observations of teachers. Administered of same Algebra I unit test for outcomes. Tallied data.
(4)Clarifying/Reviewing	Meeting with teachers and wrap-up	Clarified information as necessary and final meeting with the teachers.

Phase 1. During the first phase, the researcher used MDCPS suggested accommodations list to develop a 15-item survey instrument from recommended mathematics accommodations that were used in order to gather information on general education teachers' use of specific mathematics instructional accommodations for students with SLD (Appendix A). Prior to emailing the survey, teacher demographics such as teachers' names and specific school sites were stored in the Qualtrics Survey Software in order to trace each responder and to facilitate further communication. Other demographic information collected from the survey included the responders' certification in mathematics and whether they taught three or more students with SLD in any one of their mathematics classes.

At the beginning of the school year, a Qualtrics survey with a cover letter (see Appendix E) that fully explained the study was emailed to 185 MDCPS general education high school mathematics teachers in order to determine the accommodations that these teachers used in their classrooms in which there were students with SLD in mathematics. Additional space was provided on the survey to obtain optional write-in responses. Two reminders were sent to teachers who had not responded to the survey over a 3-week period. A total of 33 teachers responded to email and agreed to take the survey. Thirty-one (93.94%) of the responders were general education mathematics teachers and seventeen (55%) of these responders had students with SLD in their classrooms. Fifteen (88.24%) of the responders had three or more students with SLD in their Algebra 1 classrooms.

As a result of teacher responses to the survey, the researcher identified the five most frequently used instructional accommodations in mathematics. From the five most frequently used accommodations identified by the general education teachers on the survey, the researcher completed the accommodations checklist (Appendix B) that was used for the in-class teacher observations. The reliability of the observation checklist ($r = .844$) was established from the responses of four expert judges. All four expert judges taught in the Miami-Dade School District for at least 5 years, were certified in teaching mathematics at the high school level, were knowledgeable of accommodations for students with SLD in mathematics, and had experience in teaching students with varying levels of mathematics ability in the general education classroom. One of the judges was also dually certified in special education and high school mathematics.

Phase 2. In the second phase, participant selection took place dependent up pre-determined criteria. The pre-determined criteria were that participants were using the most frequently identified accommodations in their Algebra 1 classes and taught at least three students with SLD in the same classroom. Nine participants were identified from six high schools across Miami-Dade County and the participants agreed in writing to participate in the study. Most of the participants taught in schools with similar student demographics. During this phase, the researcher received permission from one or more administrators at the targeted schools and met with the selected teachers to discuss the purpose of the study, the most frequently identified instructional accommodations, pre- and post-testing procedures testing timelines, the observation data collection process and implementation of the project, incentives and the procedures of the study. A financial incentive in the form of a 60-dollar gift card was also discussed with the teachers for their participation in the study. During this phase as well, the teachers discussed with the researcher their need for training on the use of instructional accommodations for students with SLD that they taught.

Phase 3. During this phase the Algebra 1 unit pre-test and post-test were administered to coincide with the Algebra I unit on linear functions, equations and inequities (see Appendix F) that was taught over the 4-week observation period. The tests were given to students in each of the participating classes; however, the researcher focused on the scores of students with SLD and therefore, test data were analyzed for students with SLD only. The unit test was taken from the recommended teacher curriculum resources and was used for pre- and post-testing. Teachers were responsible for administering the pre- and post-test in each of their classrooms.

The same test was used for pre- and post-testing during this phase. After the pre-test was given to students in each of the targeted classrooms, four and a half hours of in-class teacher observations were conducted (three observations per teacher once per week) for a total of 39 hours of observations. Week five was used for three make-up observations and two make-up tests. Two participants in one of the targeted schools were observed for three consecutive weeks on Mondays while observations at the four other schools took place on days that the participants had their odd "A" days (periods 1, 3, 5 and 7) when they taught one class with students with SLD in mathematics.

County testing, one Early Release day, the general election day and one public holiday contributed to observation scheduling challenges. Each participant taught between three to eight students with SLD in their Algebra 1 classes that were observed, and the average class size was 24 students. During this phase also, one participant dropped out of the study after the second observation.

Teacher observations were conducted by the researcher and two peer observers during the periods in which there were three or more students with SLD in mathematics. Peer observations were conducted on Monday and Friday only and this also contributed to scheduling challenges because of schedule rotations (some Mondays and Fridays were either odd or even days when students with SLD were in the classrooms). The researcher observed all participants, including one observation alongside each peer observer. One peer observer was assigned to observe two participants at the same site while the other was assigned to observe one participant at one site. Most of the observations were conducted by the researcher.

Prior to beginning observations, the researcher met with the peer observers to discuss the rubrics of the observation checklist and for the purpose of clarifying the details of the instrument. Interrater reliability was completed for only two observations when the researcher conducted one observation each with the two peer observers. According to Wagener (2012), there are no set requirements to determine an acceptable level of reliability but there are rules of thumbs. For example, almost perfect = 0.81-100; substantial = 0.61 – 0.80; moderate = 0.41- 0.60; Fair = 0.21 – 0.40; slight = 0.00 – 0.20 (Wagener, 2012). Percentages of agreement were established from interrater reliability scores using Cohen's Kappa reliability. Interrater reliability was calculated between the researcher's scores and one peer observer's scores and yielded a score of 100 % agreement. Next, interrater reliability was calculated between the researcher's scores and the other peer observer's scores for a score of 37% agreement. In order to achieve better agreement, both the researcher and observer reviewed observation notes and clarified observations at the end of which there was an almost perfect agreement score of 100%. Observations were conducted by the researcher and peers using the same instructional accommodations fidelity checklist (Appendix B).

All observers were knowledgeable in the intervention and curriculum and were therefore able to determine the degree to which the teachers were adhering to the procedures and elements of the implementation (Crawford et al., 2012). The researcher holds a master's degree in special education and is state certified to teach special education classes from grades K-12. The researcher is also certified to teach middle school and high school mathematics and has experience in teaching mathematics in general education classes with students with SLD and in special education resource classrooms. The researcher is experienced in the preparation IEPs and in selecting appropriate mathematics instructional accommodations for students with SLD in mathematics. Both peer observers are certified to teach mathematics at the high school level, have taught high school mathematics inclusion classes in which there were students with SLD, hold master's degrees in mathematics and are graduate students majoring in mathematics instruction and curriculum development. Therefore, all observers were knowledgeable in the implementation of accommodations and in the mathematics curriculum (Crawford et al., 2012).

Phase 4. During this phase, the researcher revisited some classrooms to further clarify data as needed. Make-up final tests were also administered during this phase as well. The researcher began data analysis on the data collected. The researcher met with peer observers in order to clarify information on data collected by each observer. The time line for the completion was eleven weeks. Table 2 provides a weekly breakdown of the timeline for the phases of the research.

Table 2

Timeline for Phases of the Research

Week	Phases of the Study	Activity/Action
1	Instrument Development	Distributed questionnaire via e-mail
2	Instrument Development	Collected responses and began data tallies
3	Instrument Development	Collected responses and began data tallies
4	Instrument Development	Emailed reminders
5	Teacher Selection	Met with teachers; discussed study, testing and students. Met with peer observers
6	Testing & Observations	Group tested to obtained baseline data
7	Testing & Observations	In-class observations conducted with note-taking

8	Testing & Observations	In-class observations conducted with note-taking
9	Testing & Observations	In-class observations conducted with note-taking
10	Testing & Observations	In-class observations conducted with note-taking
11	Clarifying/Reviewing	Final meeting/makeup testing

Setting

The study was conducted in the Miami-Dade County Public School District (MDCPS). MDCPS is the fourth largest school district in the nation (Miami-Dade Statistical Highlights, 2016) with a teacher population of 18,520 teachers. The K-12 student population was 356,480, with 7.3% White non-Hispanic, 21.8% Black non-Hispanic, 69.5% Hispanic and 1.7% other. Of the 356,480 students in MDCPS, 14,390 were identified with SLD with approximately 50% being educated in general education classrooms, down 2.8% from the 2014-2015 school-year. Teachers in six high school classrooms from a total of 57 high schools in the district participated in the study. Five of the schools were located across the northeastern, and northwestern section of Miami-Dade County and one school was located in the southern part of Miami-Dade County. The student demographics for five of these schools were similar (see Table 3). The mean class size was 24 (ranging from 17 to 30) students with at least three students with SLD in mathematics. Three of the classes in this study were each co-taught by a general education teacher and an exceptional student teacher during the periods that were observed. Schools were identified using three-digit numbers preceded by zeros (see Table 3).

Table 3

Demographics of Participating Schools

	Schools					
	001	002	003	004	005	006
Race/Ethnicity						
Hispanic	92.4%	72.6%	83%	85%	13.8%	90%
Black	5.4%	23%	12%	8%	84.8%	1%
White	2%	3.4%	6%	6%	1%	8%
Other	0.0%	0.08%	0.0%	1%	.04%	1%
Total	1677	1716	1763	2154	2528	2368
Teacher-to-Student Ratio	1:23	1:18	1:22	1:18	1:22	1:25

Participants

The initial sample population of participants (n = 9) included general education mathematics teachers who were responsible for teaching students with SLD in at least one of their Algebra 1 classes. These nine teachers were selected from 185 teachers who were emailed the Qualtrics survey. One teacher dropped out of the study after the second observation and eight teachers continued throughout the rest of the study.

All participants were from schools in Miami-Dade County and each participant in the study was a full-time fully certified (grades 5-9 and 6-12) mathematics teacher employed in MDCPS to teach Algebra I to students with SLD in mathematics for at least one period per day, at least two times per week. Of the nine participants, seven were male and two were female, and their years of teaching experience ranged from 1 year to 30 years (M =18.125, SD =10.575). Table 4 provides the breakdown of the ethnicity percentages of the eight participants who completed the study.

Table 4

Demographics of Participants

Race/Ethnicity	Percentage(Amount)
White	25% (2)
African-American	50% (4)
Hispanic	25% (2)

Each participant taught between three to eight students with SLD in mathematics in the classes that were observed. Students in each of the participants' classrooms were assigned to these general education mathematics classrooms from the beginning of the school year.

Participants were identified alphabetically (A-H); student data and schools were identified numerically in order to maintain anonymity. Students were identified using consecutive numbers starting from number 1. From three schools, there were two participants each and from the three other schools there was one participant each for a total of nine teachers from six schools. Participants received a 60-dollar gift card as compensation for their involvement in the study upon completion of the observations and upon providing the researcher with all tests scores. Post-test scores were collected from eight participants since one participant dropped out of the study after the second observation. Participant demographic information on certification was obtained from the survey. Information on gender and years of teaching experience was obtained verbally by the researcher.

Data Collection Procedures

The researcher and peer observers each collected data for three observations (one observation per teacher per week) over four weeks. The fifth week was used as a make-up week for testing and final observations.

All of the schools followed a rotating one-and-a half hour block schedule (8 periods, four blocks per day). Most of the observations were conducted on the days that the participants had their "A" or odd day's schedule; however, at one school, because the teachers had the same students on consecutive days for "A" and "B" days, data was collected once per week per teacher during the fifth or sixth period.

Teacher fidelity of implementation of accommodations was determined by the number of times each accommodation was used during observations. Teacher fidelity data were recorded using a scale from 0 to 2 (0 the lowest score and 2 the highest score) for each accommodation and an overall score was obtained since researchers typically report fidelity as one overall score averaged across an entire intervention and tend to not examine or report variation, presumably under the assumption that fidelity is a stable construct (Harn, Parisi & StoolMiller, 2013). Scores obtained for the five most frequently used accommodations were tabulated and analyzed using IBM SPSS (V. 23).

Prior to beginning the formal observations, the teachers administered the Algebra 1 unit 3 pre-test on linear functions, equations and inequalities that was provided by the researcher. The pre-test scores were used to obtain a baseline measure for the outcomes of the study. Descriptive data were calculated for student pre-test scores in the selected classrooms. Student outcomes were the difference between the students' pre-test and post-test scores. Both pre-and post-tests were administered to the entire class, however, the focus and evaluation of these tests was only on the sample students with SLD in mathematics.

Instruments

Three instruments were used to collect data. Two of the instruments were designed by the researcher -- the teacher survey and the teacher observation checklist. Both instruments included items from the MDCPS recommended accommodations for students with SLD in mathematics. The third instrument was an Algebra I unit test for content knowledge of a specific unit of instruction on linear functions, equations and inequalities was used during the observation phase of the study. The Algebra 1 unit test was obtained from the Algebra 1 curriculum resources. The data collected from the test were used to compare student outcomes between the baseline pre-test and post-test scores. The same test was used for test re-test reliability.

Teacher Survey. The information obtained from the Qualtrics survey served two purposes. The initial purpose was to select the teachers for the study. The other purpose was to select teachers' most frequently used accommodations; these were modified as a checklist (Appendix A) for teacher observations. This survey included 15 of MDCPS recommended mathematics instructional accommodations located on the district's mathematics pacing guides. The survey included spaces to obtain teacher and student demographic information and was used aid in teacher selection for the study. The survey was modified to become the checklist containing the same fifteen core components of in-class mathematics accommodations with additional space for teachers to write in additional information or accommodations that they frequently use in their classes with students with SLD in mathematics. Demographic information concerning number of students with disabilities taught, number of classes in which these students were taught, teacher and school identification information was also obtained from this questionnaire.

Teacher Observations Checklist. The teacher observation checklist (Appendix B) contained the most frequently used accommodations derived from teacher responses to the survey questionnaire. These items were used to identify whether the accommodations were implemented by these teachers (Crawford, et al. 2012) in their classes with students with SLD in mathematics. Each accommodation item was defined with criteria to use as guides for scoring the level of implementation from 0 points when the implementation of the accommodation is not observed, 1 point when the implementation is observed to some degree, and 2 points when the implementation is fully observed or when it is always observed (Crawford et al., 2012). The results provided an overall implementation score and a core construct score. The total number of points awarded were used to determine the frequency of the intervention that was delivered. Only the data collected on the five high frequency criteria variables (see Table 6) from fifteen were tabulated and statistically analyzed in this study since "a general rule is to get the best solution with the fewest variables" (Tabachnick & Fidell, 2007, p. 11).

Observations were conducted using the checklist by the researcher and peer observers. According to Keller-Margulis (2012), it is more beneficial to have multiple people measure fidelity in order to get different perspectives.

Individual checklists were used during the observation of each participant and questions were noted on the checklist for clarifying ambiguous observations. The same checklist was used each time the participant was observed and therefore, contained three days of independent scores for each day that each participant was observed. This was done in order to determine the frequency of use of accommodations and the level of implementation of the required accommodations for each observation. Field notes of other observable behaviors and conditions under which the accommodations were carried out were recorded in spaces provided on the observation checklist. These additional observer field notes were used to clarify or interpret accommodations identified if there was a need for clarifying.

Algebra I Test of Content Knowledge. The Algebra I unit test (Appendix F), the third instrument, was used to pre-test students in order to establish a baseline and to determine subsequent academic gains when used as a post-test. The instructional focus for the unit was linear functions, equations and inequalities and therefore, the test questions were aligned with the unit. Although there were 11 questions on this test, students were asked to complete only the first 10 questions since question number 11 was on the topic of inequalities which was not taught by any of the participants during the 4-week observation window in keeping with the pacing guide. Questions on the test included tables of data, graphs, true and false, multiple choice and open-ended questions.

Prior to administering the pre-test, the researcher and the participants discussed the curriculum, the benchmarks and mathematical standards that were to taught in alignment with the MDCPS pacing guide during the observation period. The same pre-test was used for post-testing. Both pre-and post-tests were administered by each participant to the entire class with the focus on the outcomes of students with SLD. Pre-tests were administered prior to the commencement of observations. The post-tests were administered by each participant after the final observation was completed in each classroom within a one-to two-week period. Student outcome measures were determined by the change between pre-and post-tests scores on the first 10 questions of a unit test on linear functions and equations only. Tests scores for 27 students altogether were used in this study. Two students from two different schools who took the pre-test dropped out of the study prior to taking the post-test.

Validity of Instruments

Validity and reliability are two fundamental elements in the evaluation of a measurement instrument and is the extent to which an instrument measures what it intends to measure (Tavakol & Dennick, 2011). Content validity, also known as logical validity (Newman, Lim, & Pineda, 2013), estimates how representative instrument items are of content or subject matter that the instrument is seeking to measure (Newman, Newman & Newman, 2011). For this study, the Algebra 1 test that was provided for the participants was obtained by the researcher from MDCPS Algebra 1 curriculum resources and was designed for pre-and post-testing of the unit. All of the items on the test were in alignment with the mathematics standards related to linear functions, equations and inequalities that were taught during the observation period and therefore, test content was aligned to the instructional unit (Appendix F).

Content validity of the survey was determined from responses given by Expert Judges. According to Newman, Lim and Pineda (2013), a Table of Specifications (TOS) is used to align a set of items, tasks or evidence with the set of concepts to be assessed. For this study, each Expert Judges was given a TOS (see Appendix C) and indicated their agreement with the constructs using check marks. Percentage of agreement for each item among the Judges was calculated. The four constructs that were checked for validity included instructional methodology and materials, class assignments and assessment, learning and classroom environment, time demands and schedules. There were 15 items within the four constructs. Judges' agreement on the content or constructs of the questionnaire yielded a score of 80% which is an acceptable percentage in order to establish validity of this instrument.

For the observation checklist that was developed from the questionnaire, content validity was established since five of the items (the most frequently used accommodations) on the questionnaire were the items of focus on the teacher observation checklist. The average of these five items became the predictor variable that was used to determine teacher FOI of accommodations. Rubrics were established for the observation checklist in order to maintain consistency in scoring (see Appendix B).

Reliability

The reliability of an instrument does not depend on its validity, but is concerned with the ability of an instrument to measure consistently (Tavakol & Dennick, 2011). For this study, the researcher designed the Qualtrics questionnaire which was used to prepare the observation checklist. Cronbach's Alpha reliability (r = .844) was determined. The amount of measurement error for the group of items on the instruments therefore, was determined by the reliability estimate. For the five high frequency items that were used to prepare the teacher observation checklist, the reliability scores of $r > .80$ were obtained.

Quantitative Data Analysis

In order to explore the relationship between teacher fidelity of implementation (FOI) of selected high incidence accommodations for students with SLD in general education mathematics classrooms and student achievement determined by the results of an Algebra 1 unit test, the researcher collected descriptive data (i.e., survey data and test scores). Frequencies and percentages were obtained from the analysis of teacher responses to the survey questions on the accommodations that they used. Next, student tests scores on the Algebra 1 unit on linear functions, equations and Inequalities were graded in order to establish a base line for each student and, later, to calculate the difference between pre- and post-tests scores, means and standard deviations. Observation data on teacher FOI were collected using the checklist and the data were tallied for the five predictor variables across three observations. Finally, mean participant FOI scores were used to analyze the relationship between these scores and the difference in student scores on the Algebra 1 post-test using linear regression analysis to predict the relationship.

Qualtrics Survey

The survey instrument contained fifteen items. Participants' responses to all items were automatically tallied by Qualtrics and presented on graphs, tables in totals and percentages. The researcher exported the survey data to the IBM SPSS Statistics (V. 23) in order to verify frequencies and percentages. Participant demographic data was also analyzed in order to determine mean teaching experience and the standard deviation.

Mathematics Achievement

Pre-and post-test data were obtained from the results of the unit test on linear functions, equations and inequalities. The test questions (n =10) were on solving problems on using tables of data, graphs, multiple choice questions, true or false questions, and open-ended answer responses. Questions answered correctly were coded as 1 and unanswered or incorrectly answered questions were coded as 0 (Loflin, 2015). Total raw scores for 27 students were determined for each student by summing their item responses (Loflin, 2015). Each student's pre-test raw score was subtracted from his or her post-test raw score to produce a change score (Loflin, 2015). These change scores (difference) were the criterion variables that were used to establish the relationship with teacher FOI.

Observations

In order to determine fidelity of implementation, observational measures of adherence have been used frequently in the literature and competence has been examined less often (Schoenwald and Garland, 2013). Frequency data were collected for a total of three observations conducted for each participant using the observation checklist. For each of the five predictor variables that were observed, scores that ranged from 0 to 2 were summed and a total for the three observations was obtained. A score of 0 was given if the activity was not observed, a score of 1 was given if the activity was observed only one time and a 2 was given if the activity was observed or two or more time during each observation session. Participants' identification on each of the five predictor variables were entered in the variable view of the Statistics program. The total participant FOI scores for each predictor variable were entered for into the data view in order to calculate their means and standard deviations.

Fidelity and Student Mathematics Achievement

The mean and standard deviations of each participant FOI scores were calculated at the end of the observation stage. For each participant observed, scores were calculated for each of the five predictor variables over the three observations. According to Harn et al. (2013), researchers typically report fidelity as one overall score averaged across an entire intervention and that they tend not to examine or report variation, presumably under the assumption that fidelity is a stable construct. In addition, most of the attempts to validate fidelity criteria have been done by aggregating individual data within programs and conducting analysis at the program level, while ignoring within-program variability (Mowbray et al., 2003). As such, for this study, the analysis of fidelity data was done by averaging scores across the entire intervention. Data collected on the participant who dropped out were not used in the calculations.

The analysis of data between fidelity implementation and student test scores was conducted using linear regression in order to predict the contribution of overall FOI scores to the change in student knowledge. In order to determine significance of the relationship with a 95% confidence level $\alpha = .05$ was used. The reason why $\alpha = .05$ was chosen since the cost of rejecting the research hypothesis in error was not so serious as to justify a more strict confidence level.

Summary

This chapter presented the methodology chosen for this study. An ex post facto design was used to examine the most frequently used instructional accommodations by general education mathematics teachers and the relationship between teachers' use of these accommodations and the achievement of students with SLD in their classrooms. This chapter discussed the subjects, instrumentation, procedures and statistical treatment that were used in the research. Quantitative analyses were also presented in this chapter.

The study occurred in schools in the Miami-Dade County School District, the fourth largest school district in the nation. First, the Qualtrics survey was sent out to 185 general education mathematics teachers in the district at the beginning of the school year in order to determine what were the five most frequently used accommodations that these teachers use in their classrooms with students with specific learning disabilities (SLD) in mathematics. Nine Algebra 1 teachers who met the research criteria were selected for the study and were each observed three times during one class period over a four-week period. Because one participant dropped out of the study after two observations, eight teachers remained and were observed three times during one class period over a four-week period.

In-class observations were conducted by the researcher and two peer observers using the researcher-prepared teacher fidelity checklist in order to determine teacher adherence to the use of instructional accommodations for students with SLD. An Algebra 1 test to determine a change in student achievement was used for pre-and post-testing during the observation period and the validity and reliability of instruments were discussed in this chapter. All survey, demographic, and achievement data collected were entered into an SPSS (V. 23) data file for analysis. Statistical procedures for data analyses were for two-tailed, non-directional tests using linear regressions. The results of the study are presented in the next chapter.

CHAPTER IV

RESULTS

This exploratory study examined the relationship between teacher fidelity of implementation of accommodations for students with SLD in general education Algebra 1 classes and student achievement. In this section the researcher presents the findings of the study. The researcher presents the research questions, descriptive statistics, the test of statistical regression assumptions and then the hypothesis. The chapter ends with a summary.

Research Questions

As outlined in the previous chapter, the researcher sought to answer the following research questions:

1. What are the five most frequently used instructional accommodations that general education teachers report using in Algebra 1 inclusion classes that contain students with SLD?

2. Is there a positive relationship between (a) the implementation score of selected "high incidence" accommodations for students with SLD that are employed by general education teachers and (b) mathematics achievement of these students determined by the results of an Algebra 1 unit test?

Hypothesis. There is a positive relationship between teacher implementation score of selected "high incidence" accommodations for students with SLD that are employed by general education teachers and mathematics achievement determined by the results of an Algebra 1 unit test.

Descriptive Statistics

From a total of 185 teachers, 33 (18%) responded to the survey. Of these, 31(17%) responded "Yes" to the first question, "Are you a general education teacher," and were allowed to move on to the next survey question on their area(s) of mathematics certification. Twenty-eight were certified in mathematics grades 6-12 only and three were certified in both mathematics grades 5-9 and 6-12. For the next question, "Do you teach grade 9 – Algebra 1," 19 responded "Yes." As a result, the 12 participants who responded "No" to this question were exited from the survey. From the 19 who met the criteria so far, 17 stated that they taught students with SLD in at least one of their Algebra 1 classes (see Figure 1). Fifteen of the 17 responders reported that they taught $3\geq$ students with SLD in at least one period and were asked to check all of the accommodations that they used in these classes with students with SLD. Nine of the 15 responders agreed to become participants (see Figure 1).

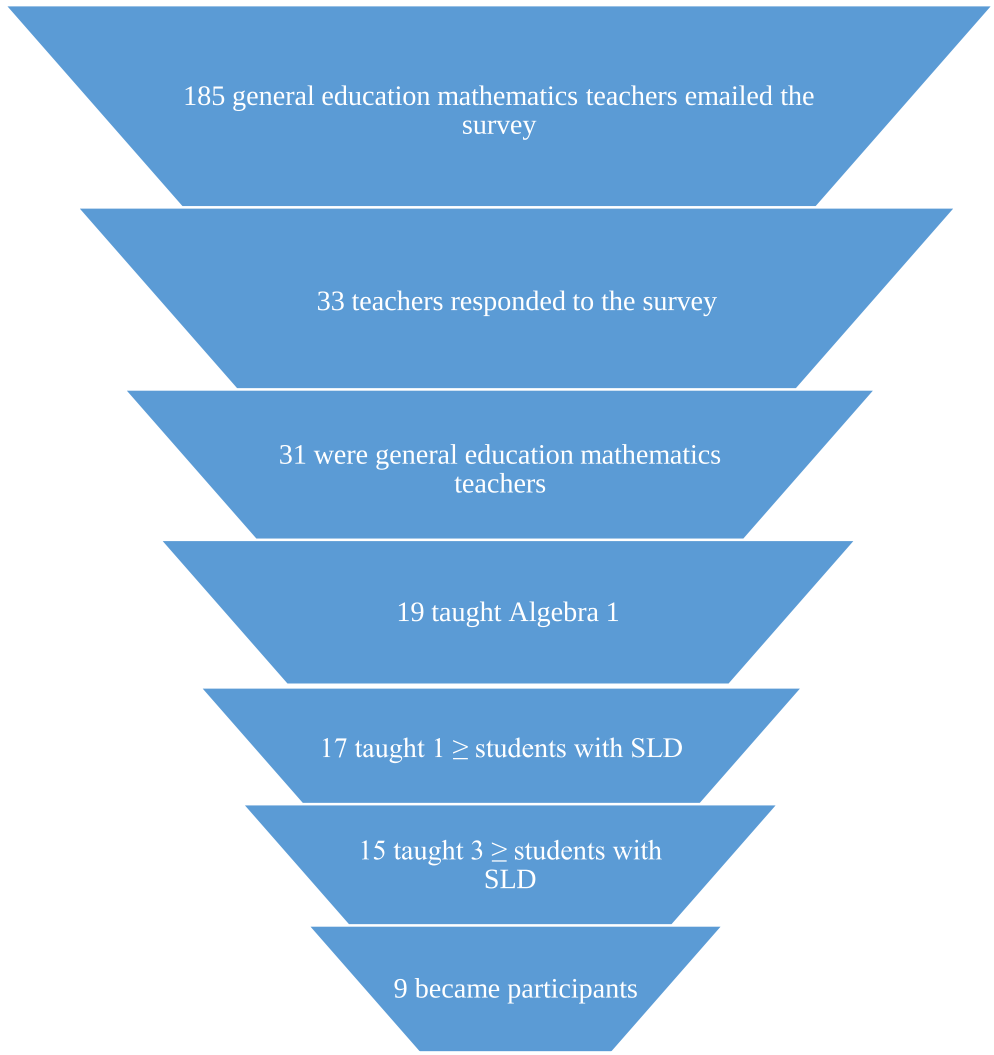

Figure 1. Participant Flow Chart. This shows a process of elimination as fewer and fewer teachers were allowed to complete follow-up questions to the survey because of their disqualifying responses until the actual qualified participants remained.

To answer the first research question, the Qualtrics survey was used to identify the five most frequently used accommodations. Descriptive statistics were used to report the findings of the 15 items contained in the survey sent to all teachers (see Table 5) and these responses revealed the five most frequently used accommodations that are described in Table 6.

Table 5

Survey Data on Accommodations

Accommodation	Frequency	Percentage of Responders	Responses by Percentage
1	11	33.3	64.71
2	11	33.3	64.71
3	8	24.2	47.06
4	6	18.2	35.9
5	17	51.5	100
6	16	48.5	94.12
7	11	33.3	64.71
8	15	45.5	88.24
9	15	45.5	88.24
10	1	3.0	5.88
11	14	42.4	82.35
12	13	39.4	76.47
13	16	48.5	94.12
14	10	30.3	58.82
15	11	33.3	64.71

Note. M = 11.67; SD = 4.30

Table 6

Descriptions and Data on High Frequency Accommodations

Accommodation	Description	Frequency	Percentage
1.	Teacher provides sample problems of varying levels	17	100
2.	Teacher provides guides or prompts, personal assistance – e.g. peer, volunteer or aide	16	94.12
3.	Teacher provides access to extended resources and equipment – e.g. access to mathematics related computer activities or other related media	15	88.24
4.	Teacher provides preferential seating – e.g. near teacher, with a peer or volunteer or aide	15	88.24
5.	Teacher provides additional time to complete class assignments or class projects	16	94.12

The predictor variable (i.e., the mean of instructional accommodations) for the study was determined from teacher responses to each question and ranged from 1 (e.g., providing a study carrel) to 17 (M = 11.67, SD = 4.30). The findings were that all 17 teachers who met the criteria for the study, reported that they provided sample problems of varying levels during instruction. Sixteen (94.12%) teachers reported that they used guides or prompts or personal assistance. Examples of personal assistance were provided by either the teacher, a peer, a volunteer or aid. The same percentage (94.12%) of teachers reported that they provided additional time for students to complete assignments and class projects. Fifteen (88.24%) teachers reported that they provided extended access to instructional resources and equipment which included access to mathematics related computer activities or other related media. Fifteen teachers also indicated that preferential seating near the teacher, peer volunteer or aid was used.

For the remaining 10 accommodations, the findings were that 14 (82.35%) teachers provided instruction in small groups or one-to-one with a peer, volunteer or aide. Thirteen (76.47%) teachers provided in-class assistance with organization. Eleven (64.12%) teachers provided assistance with note-taking and provided concrete objects, pictures and graphs. Ten (58.82 %) teachers assigned fewer questions to be completed in-class or at home. Eight (47.06%) teachers provided study guides and guided notes. Six (35.29%) teachers provided fewer, uncluttered, highlighted or color-coded items and only 1 (5.88%) teacher provided a study carrel (see Table 6). For the optional write-in responses, which were not calculated in the data analysis, one teacher reported using differentiated instruction, and one other reported providing tutoring during lunch and after school as an accommodation under the category of "setting accommodation." The average data of the five most frequently used accommodations (see Table 7) obtained from the results of the survey was used as the predictor variable for the study in order to answer Research Question 2.

Statistical Regression Assumptions

It is the assumption that the populations from which samples are drawn have specific characteristics and that samples are drawn under certain conditions. It is important, therefore, to conduct a statistical analysis prior to testing the hypothesis since different tests make different assumptions about the distribution of the random variable being sampled in the data. These characteristics and conditions are expressed in the assumptions of the hypothesis tests. As such, prior to testing the hypothesis, the researcher performed statistical analyses of assumptions graphically and in some cases numerically. These analyses are used to screen the data that is being analyzed from deviant cases that may be extreme outliers and/or have undue influence on the results (Benner, Nelson, Stage, & Ralston, 2011). When assumptions are met, the chances for making errors are reduced, and the robustness and accuracy of the research findings are improved. The data were therefore screened for missing values and violations of assumptions prior to analysis. There were no missing data and the following are descriptions of the tests for the assumptions.

Normality as a statistical test is used to determine if a data set is well-modeled by normal (symmetrical) distribution and to compute how likely it is for a random variable underlying the data set to be normally distributed. The assumption of normality was tested by examining standardized residuals. The histogram (Figure 2) shows a bell curve with relatively normal distributed criterion data (difference between pre-and post-test scores). Most of the data fall with 2 standard deviations with a mean of 0. Visual inspection of the histogram in Figure 3 indicates a relatively normal distribution of the criterion variable. The data show that a score of 4 appears once, 1 appears twice, 0 appears three times, 1 appears six times, 2 appears once, 3 appears three times, 4 appears four time, 5 appears three times, 6 appears twice, 7 appears once and 9 appears only once. The box plot (see Figure 4) also shows normally distributed teacher FOI data (range from 2.2 to 3.2) for seven participants and one outlier which does not influence the results. The outlier represents the mean teacher FOI score of 1.4.

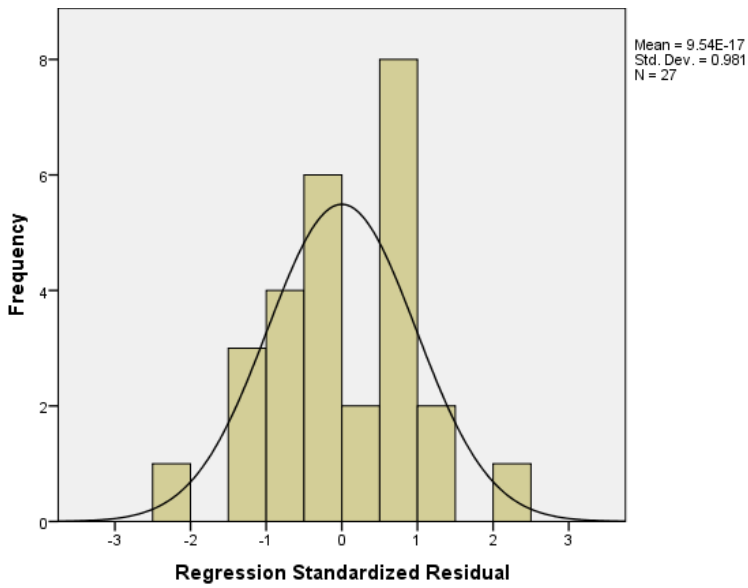

Figure 2. Histogram of Standardized Residual. This shows a bell curve suggests normally distributed data for the criterion variable (student test data) with 95% of the student scores between 1 and 2 standard deviations from the mean.

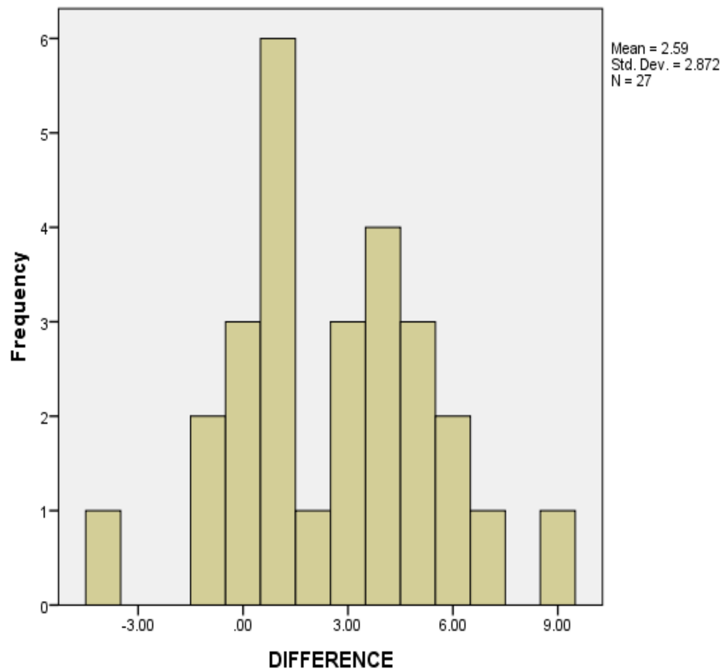

Figure 3. Histogram of Distribution of Criterion Variable. This indicates a relatively normal of the frequency of the criterion variable – Difference (difference between pre- and post-test scores).

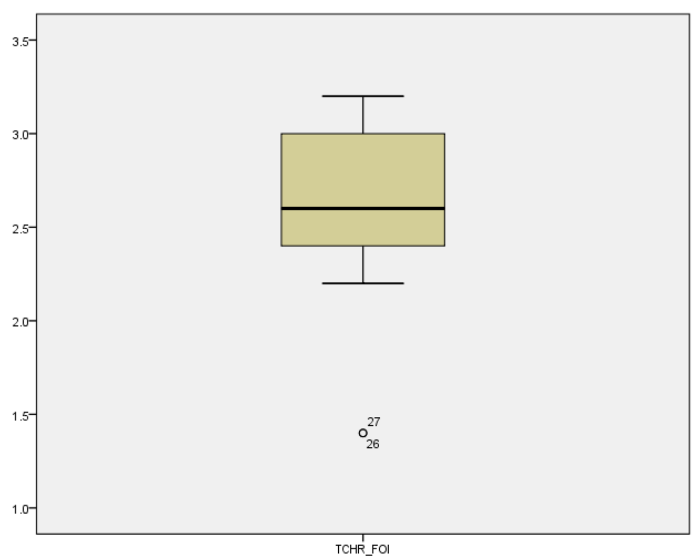

Figure 4. Box Plot for Predictor Variable. This indicates relatively normal data for predictor variable (Teacher FOI) showing only one outlier. FOI = Fidelity of Implementation.

The researcher also conducted numerical analyses of the data. A review of the Shapiro-Wilk (SW) test, the Kurtosis test statistic and a test for skewness of the data were used to further determine normality. The SW statistic is appropriate for small sample sizes ($n < 50$) such as the sample size of the criterion variable in the current study ($n = 27$). The statistics of the SW test ($SW = .864$, $df = 27$, $p = .800$) suggested that normality was a reasonable assumption for the variable since $p > .05$.

Kurtosis is a useful measure of whether there is a problem with outliers in a data set. Larger kurtosis indicates a more serious outlier problem. For this study, the Kurtosis statistics (0.69) suggested that normality was a reasonable assumption since the statistic is close to 0.

The numerical test statistic for skewness also indicated approximate normality (.044). If skewness is 0 it means that the data are perfectly symmetrical. If skewness is less than -1 or greater than 1 it means that the data is skewed. If skewness is between -1 and - 0.5 or - 0.5 and 0.5, the data is moderately skewed. In the current study, a skew of .044 is within the normal range since it is close to 0.

Independence testing is conducted in order to determine that the row and column variables of the study are independent of each other. Independence testing is used when there are two or more variables that are being tested. Two variables are independent if knowledge of the value of one variable provides no information about the value of another variable (e.g., Teacher FOI and student achievement). For this study the Durbin-Watson (DW) statistic test was calculated (DW = 1.021). This value indicates a positive relationship between the data (Teacher FOI and student achievement). The value obtained is also between the critical values of 0 and 4 and is therefore, considered an acceptable value in order to assume independence of the variables.

Homoscedasticity is a statistic test in which one variable has the same variance as the other variables. The box plot in Figure 5 shows the variance between the observed data of the criterion variable and the norm. Most of the scores, except one outlier hover around the mean of 0. This visual output indicates homoscedasticity of the criterion variable.

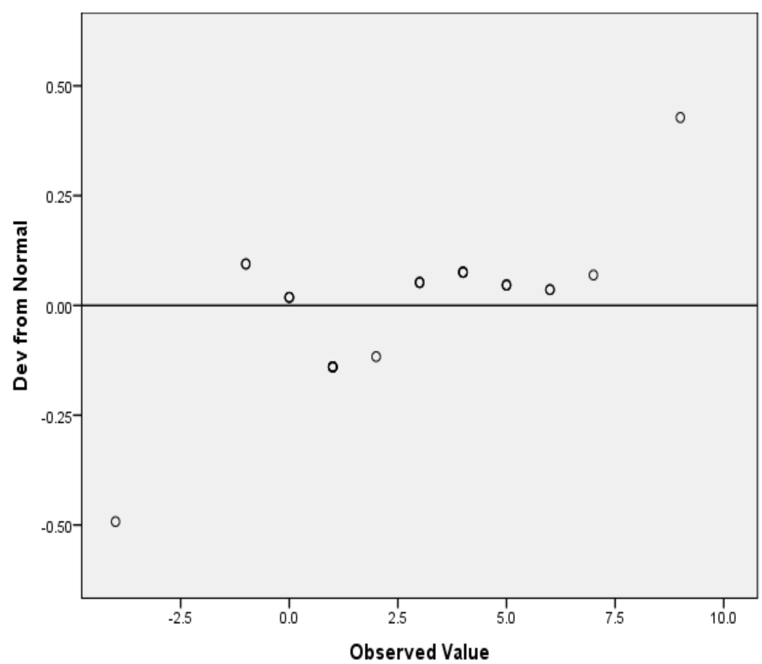

Figure 5. Scatterplot for the Assumption of Homoscedasticity. The criterion variable data is met on the scatter plot which shows the data are scattered around a mean horizontal line (0) with only one outlier at (9, 0.04).

Linearity refers to a mathematical relationship or function that can be represented by a straight line on a graph in which two quantities are directly proportional to another. Figure 6 shows a linear relationship between observed and expected teacher fidelity scores. Figure 7 shows linearity between the observed and expected improvement in student scores (criterion variable). Only when linearity is observed we can use linear regression to test the hypothesis.

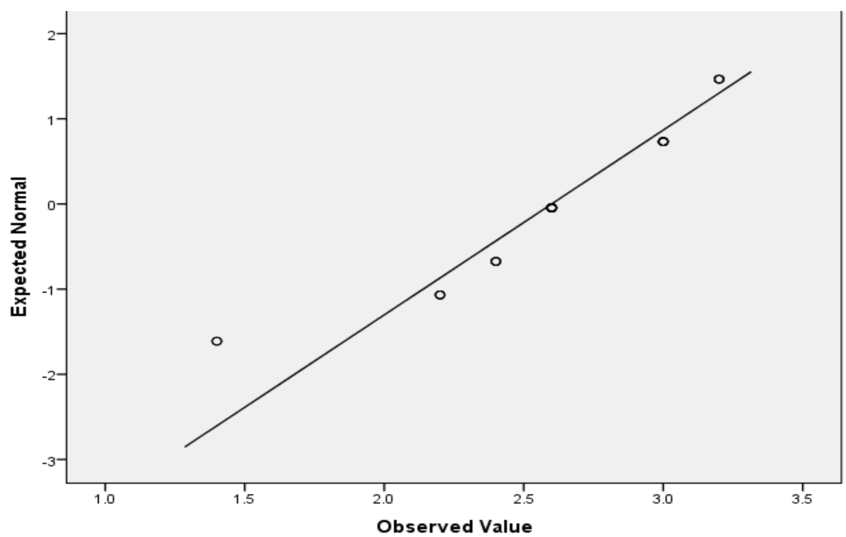

Figure 6: Scatterplot for Linear Relationship of Predictor Variable. This shows a linear relationship between the observed value and expected normal Teacher FOI data.

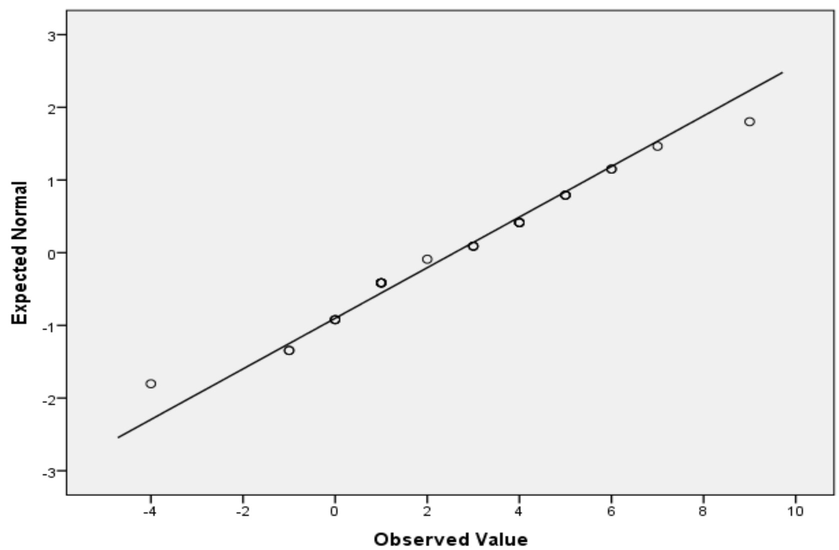

Figure 7: Scatter Plot for Linear Relationship of Criterion Variable. This shows linearity between the observed criterion scores and expected normal criterion scores.

Statistical regression assumptions of normality, independence, homoscedasticity and linearity were all met; therefore, a simple linear regression analysis was used to test the hypothesis. Mean Teacher FOI scores and student scores (difference) were entered into the regression equation in order to test the hypothesis.

Test of Hypothesis

In this section, the researcher provides data on the predictor variable (teacher FOI of accommodations) and student outcome data (difference) that were entered into the simple linear regression equation.

For this study, there was only one hypothesis to answer the second research question. Prior to testing the hypothesis, the researcher used Cronbach's Alpha to determine the reliability coefficient for the instrument. The Alpha coefficient (r = .844) that was obtained shows that the instrument was reliable and was therefore used to prepare the observation checklist. The researcher and two peer observers used the observation checklist for in-class teacher observations in order to determine teacher fidelity of implementation of instructional accommodations. Cohen's Kappa Reliability was used to determine interrater reliability of the observations. Interrater reliability was calculated between the researcher's scores and peer observers' scores. Initially the results were 37% and 100% agreement respectively. In order to achieve a better agreement than 37%, both the researcher and the observer reviewed observation notes and clarified observations at the end of which there was 100% agreement.

In order to answer Research Question 2, the mean of the five high frequency accommodations (predictor variable) on the observation checklist (see Table 6) were used to measure teacher fidelity on their implementation of instructional accommodations for students with SLD. The implementation of accommodations was determined by a rubric with scores ranging from 0-2 with a score of zero indicating that the accommodation was not observed, 1 indicating that it was observed once and 2 indicating the accommodation was observed two or more times. Teacher FOI was determined by observing each participant on three separate occasions (one observation per week). Observations were conducted by the researcher and two peer observers.

The following is a description of the predictor variable and teacher FOI data, followed by student tests data that were used to test the hypothesis:

Hypothesis: There is a positive relationship between teacher implementation score of selected "high incidence" accommodations for students with SLD that are employed by general education teachers and mathematics achievement based on the results of an Algebra 1 unit test.

Variable 1 measured the number of sample problems of varying levels that the teacher provided during instruction (M = 5.75, SD = .46). Variable 2 measured how often the teacher provided guides or prompts or personal assistance during instruction (M = 3.38, SD = 2.20). Variable 3 was measured by how often the teachers provided preferential seating near the teacher, with a peer, a volunteer or an aid (M = 2.88, SD =.99). Variable 4 was measured by how often the teacher provided extended access to instructional resources and equipment, i.e. mathematics related computer activities or other related media (M = .13, SD = .35). Variable 5 was measured by how often the teacher provided additional time to the students to complete assignments and class projects (M = .63, SD = .92). For each accommodation or variable, FOI scores for three observations ranged from a total of 0 to 6 (i.e., use of the accommodation not observed to the accommodation observed two or more times). Table 7 provides the descriptive data for teacher FOI scores. Means and standard deviations are also presented. In addition to reporting FOI scores, mathematics outcomes are also reported.

Table 7

Data on Teacher Fidelity of Implementation of Accommodations

	FOI Scores						
Teacher	1	2	3	4	5	M	SD
A	6	5	3	0	2	3.2	2.39
B	6	0	3	0	2	2.2	2.49
C	5	5	3	0	0	2.6	2.51
D	6	3	3	1	0	2.6	2.30
E	6	5	4	0	0	3.0	2.83
F	6	4	1	0	1	2.4	2.51
G	6	5	4	0	0	3.0	2.83
H	5	0	2	0	0	1.4	2.19

Note. The variables are the accommodations and each score is the total of three observations on a scale of 0-2. FOI = Fidelity of Implementation.

In order to determine mathematics outcomes (the criterion variable), the same Algebra 1 unit test was administered as pre-and post-test. The topic of the test was Linear Functions, Equations and Inequalities and raw pre-and post-test data (Loflin, 2015) for 27 students with SLD in mathematics were analyzed. Initially, 37 students took the pre-test; however, due to the loss of one teacher and the subsequent loss of 10 students (eight students from the teacher who dropped out and two students from two other teachers), 27 pre-and post-test scores were analyzed. There was some significance between the overall pre-test (*M* = 3.11, *SD* = 2.61) and post-test scores (*M* = 5.33, *SD* = 3.33). The means and standard deviations associated with teacher FOI scores and the difference in student tests scores are provided in regression Table 8.

Table 8

Descriptive Statistics

	Mean	Std. Deviation	N
DIFFERENCE	2.5926	2.87241	27
TCHR_FOI	2.6000	.46077	27

Note: TCHR_FOI = Teacher Fidelity of Implementation
Dependent Variable: DIFFERENCE

Table 9 provides information on the number of years of teaching experience for each participant and teacher mean FOI data. In Table 9, means and standard deviations of pre-and post-test scores are also provided along with data on the changes in student scores (differences).

Table 9

Summary of Teacher and Tests Data

Teacher	Teaching Experience in Years	Mean Teacher FOI Scores	Pre-Test	Post-Test	Difference
			M(SD)	*M(SD)*	*M(SD)*
A	10	3.2	4.67(3.21)	8.00(4)	3.33(2.52)
B	26	2.2	7.67(4.04)	7.00(5.29)	-.67(2.89)
C	1	2.6	2.00(1.73)	.33(.58)	-1.33(2.31)
D	7	2.6	2.43(1.81)	6.71(1.50)	4.29(1.60)
E	30	3.0	1.33(1.15)	7.67(3.06)	6.33(3.06)
F	24	2.4	2.67(.58)	2.33(.58)	-.33(1.15)
G	22	3.0	2.00(1.00)	5.00(1.00)	3.00(1.00)
H	25	1.4	3.00(1.41)	3.5(.71)	.50(.71)

Note: FOI = Fidelity of Implementation.

A simple linear regression analysis was conducted to evaluate how well teacher fidelity of implementation of instructional accommodations related to student achievement in mathematics. A significant regression equation was found. See Table 10 for the ANOVA.

Table 10

ANOVA

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	34.500	1	34.500	4.791	.038[b]
	Residual	180.019	25	7.201		
	Total	214.519	26			

Dependent Variable: DIFFERENCE

As teacher FOI increased by 1 point, student test scores increased by 2.5 points. Table 11 shows values of the coefficient for FOI and the constant for the following regression equation:

$$Difference = -3.91 + 2.5(FOI)$$

Table 11

Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	-3.907	3.014		-1.296	.207
	TCHR_FOI	2.500	1.142	.401	2.189	.038

Note: Std. = Standard. Sig. = Significant. TCHR_FOI = Teacher Fidelity of Implementation

In Table 12, the upper and lower bounds of the 95% confidence interval for the slope of teacher FOI does not contain the value of zero. Therefore, overall fidelity of implementation is significantly related to student achievement. As hypothesized, the higher fidelity scores, the greater the student achievement.

Table 12

Confidence Interval for the Slope

Model		95.0% Confidence Interval for B	
		Lower Bound	Upper Bound
1	(Constant)	-10.115	2.300
	TCHR_FOI	.148	4.852

Accuracy in predicting student achievement was moderate. Table 13 shows that there is a positive relationship (*r* = .40) between teacher FOI scores and student outcomes (Difference) determined by the results on the Algebra 1 test. Approximately 16.1% of the variance of FOI of accommodations accounted for the difference in student test scores as shown in the Model Summary (see Table 14).

Table 13

Correlations

		DIFFERENCE	TCHR_FOI
Pearson Correlation	DIFFERENCE	1.000	.401
	TCHR_FOI	.401	1.000
Sig. (1-tailed)	DIFFERENCE	.	.019
	TCHR_FOI	.019	.
N	DIFFERENCE	27	27
	TCHR_FOI	27	27

Table 14

Model Summary

					Change Statistics[b]				
Model	R	R Square	Adj. R Square	Std. Error of the Estimate	R Square Change	F Change	df 1	df 2	Sig. F Change
1	.401[a]	.161	.127	2.68342	.161	4.791	1	25	.038

a. Predictors: (Constant), TCHR_FOI

b. Dependent Variable: DIFFERENCE

Summary

This chapter presented the quantitative findings of the current study. The results of the survey indicated that the teachers most frequently identified that they used sample problems of varying levels of difficulty during instruction and were least likely to use a study carrel to accommodate students with SLD in their general education mathematics classrooms. The results of the survey also provided the researcher with information to prepare an observation checklist containing the five most frequently used accommodations as the predictor variables for the study.

For the criterion variable, student outcomes, data for 27 students were analyzed and by comparing the results of the post-test to the pre-test, there was an overall improvement in student performance with a mean score of 2.59 (*SD* = 2.87). The analysis of the linear regression model indicated that there was a positive correlation between teacher FOI and student outcomes. Prior to performing the regression analysis to determine the relationship between teacher fidelity of implementation of accommodations and student outcomes on an Algebra 1 test, the researcher conducted diagnostics in order to determine the linearity, normality, independence and homogeneity of the data. The results of the regression analysis indicated that the degree to which teachers implemented instructional accommodations in their Algebra 1 classes was a factor in student achievement on the test and as such, 16.1% of the variance of fidelity implementation of accommodations accounted for the difference in student test scores. Data analyses conducted at $\alpha = .05$ were significant and therefore, the null hypothesis was rejected.

CHAPTER V

DISCUSSION AND RECOMMENDATIONS

In this chapter, the researcher discusses the findings, limitations, recommendations and implications of the study. In addition, recommendations for future research and implications are also discussed.

Discussion

This study explored the relationship between Teacher FOI of high incidence accommodations for students with SLD in general education mathematics classrooms and student achievement in Algebra 1 in the Miami-Dade County Public School System. Instructional accommodations provide support to students with SLD in the general education classroom (Vallecorsa, 2000) as such, student IEPs should realistically reflect the support needed in general education classrooms. However, IEP accommodations vary from student-to-student. As such, the focus of this study was to first determine what were the five most frequently used accommodations reported by general education mathematics teachers, then teacher FOI in implementing these accommodations. The researcher obtained the list of accommodations from the MDCPS Algebra 1 pacing guide for the purpose of this study. These broadly identified accommodations in the pacing guide were placed in the survey that was emailed by the researcher to teachers. Therefore, these teachers were free to select from a wider range of accommodations than those that may have been provided on their students' IEPs.

From a previous study conducted in 2006 by Maccini and Gagnon, the researchers found that teacher use of accommodations for students with SLD may have been determined by teacher characteristics, level of education and certification, and teacher training. In the current study therefore, the researcher first surveyed general education mathematics teachers who taught students with SLD in their classrooms, then used the teacher input in order to develop the teacher FOI observation checklist. The survey items were the accommodations from the MDCPS pacing guide and there were provisions for teachers to write in their additional responses. From the researcher's perspective, accommodations checked by teachers in the survey questionnaire were more than likely reflective of their personal traits and their comfort level in implementing the accommodations with fidelity.

According to O'Donnell (2008), few researchers have examined the impact of teacher FOI on student outcomes although some have suggested that "high-fidelity implementation enhances intervention outcomes" (Loflin, 2015, p. 376). Other studies have shown no clear relationship between fidelity and outcomes (Zvoch, 2009) or a negative association has been observed. As such, Loflin (2015) sought to determine the relationship between teacher FOI of a researched-based physical education intervention and student outcomes in six middle school physical education classes. Loflin (2015) collected, analyzed and reported both quantitative and qualitative data, developed themes and rubrics from teacher responses to a survey.

Unlike Loflin (2015), the researcher in the current study chose a quantitative research method only. The researcher focused on estimating the relationship between treatment delivery indices and recipient outcomes (Durlack & Dupre, 2008; Noell, 2008; O'Donnell, 2008; Zvoch et al., 2007). For this study also, the treatment delivery indices were instructional accommodations and the recipient outcomes were the differences between students' pre- and post-test scores on an Algebra 1 test. In education, researchers generally measure and report structural and process measures of fidelity. When researchers use structural measures of fidelity, they take an objective look at whether important pieces of the intervention were delivered (Harn et al., 2013) as in the current study. Process measures of fidelity; however, allow researchers to examine the quality of delivery of the intervention (Harn et al., 2013). According to Harn et al. (2013), data collection on structural measures of fidelity is easier and more reliable to gather and mathematics outcomes were predicted best by a structural process. Process measures of fidelity are complex and more challenging to measure (Harn et al., 2013); therefore, for this study, the researcher collected structural measures of teacher fidelity.

According to Mowbray et al. (2003), there are issues in measuring fidelity. Some of the issues in measuring fidelity qualitatively include participant bias in terms of being overly positive or overly negative. Other issues arise when relying on participants to accurately report their activity or lack thereof (Mowbray et al., 2003). These issues are lessened, however, when the fidelity scale utilizes objective, behaviorally anchored criteria as in the current study, for each scale point, involving little inference (Mowbray et al., 2003).

Historically, researchers have taken different approaches to analyzing fidelity measures (Century, Rudnick, & Freeman, 2010), typically by totaling scores assigned to different aspects of the intervention while others have used gradations of fidelity tied to specific requirements. For this study, the researcher totaled scores for each predictor variable and found the mean fidelity scores for each participant (see Table 7). In analyzing the mean fidelity scores for each participant, the results indicated that there was one outlier (see Figure 6) which slightly skewed the results of the data. Therefore, it was noted that the outlier had more teaching experience than most of the other teachers yet another participant with a similar number of years of teaching experience received a higher overall fidelity score than most of the other participants. Therefore, years of teaching experience showed no significance in determining teacher FOI.

With respect to student mathematics outcomes, overall pre-test (M = 3.11, SD = 2.61) and post-test scores (M = 5.33, SD = 3.33) showed that students had little to no prior knowledge on the topic. According to Loflin (2015), researchers have found that learning proceeds primarily from relevant prior knowledge and only secondarily from the information taught. Although Algebra 1 has recently become part of the middle school curriculum in the Miami-Dade School District, it is unclear whether any of these students in this study were exposed to the content on the pre-test in middle school.

Student achievement may be considered below the level of what most educators would consider proficient in spite of the instructional accommodations that were implemented. However, from the analysis of the data presented on Table 8 and observation notes, students with SLD in the three classrooms that were served by both a general education and a special education teacher, scored higher on the post-test than the four other classes with only a general education teacher. Observer notes revealed that in classrooms with a special education and general education teacher, the special education teacher closely monitored all of the students, especially students with SLD and kept all of the students in the classroom on-task most of the time. In another classroom in which teacher FOI score was 2.2, student mean pre- and post-test scores were among the highest (see Table 8). In this highly organized print-rich classroom, there was consistency in structure and teacher expectations. Students were regularly reminded about teacher expectations about their behavior and academics, and instruction was conducted in a systematic manner with no down-time. These students were therefore, on-task at all times. Also, this teacher did not always follow the stringent time demands of county's pacing guide, but relied on student understanding of the current topic before moving on to the next in order to give these students the necessary foundation for the topic that followed.

Limitations

This study focused on the implementation of instructional accommodations in general education mathematics classroom. Of the 185 general education high school mathematics teachers emailed, the response rate was low; however, this may be attributed to the fact that in the past year, geometry has become a beginning mathematics class in many high schools since Algebra 1 has been added to the middle school curriculum.

Although the results of the study are promising, five important limitations exist in this current study. First and foremost, generalization of findings may be at risk because of the small sample size due to the low response rate. In spite of sending reminders by email and in person, the response rate remained low. Another limitation to the study was that observations were limited to one per week per teacher (3 observations each) and observations may not always give a clear indication of the quality of instruction because people act differently when they are being observed.

Next, the study focused on a narrow algebra topic, linear functions, equations and inequalities and was limited to the students' answers to test questions representing the knowledge they gained on solving problems related to this topic. The results of the test may not accurately reflect the depth of knowledge gained by the students, depending on student motivation during the testing window.

In addition, due to the unique student samples (five of the schools had a predominantly Hispanic population) chosen for the study, the results may or may not be generalizable to all schools or to similar schools with similar student populations. Researchers have identified that fidelity can vary by school site (Harn et al., 2013; 0dom et al., 2010; Zvoch et al., 2007).

The fifth limitation to this study was that a simple linear regression was used to analyze the data; however, most studies on fidelity of implementation use complex statistical models to test hypotheses because the use of multilevel modeling techniques has several advantages over traditional single level regression or analysis of variance models (Zvoch, 2012). In this study, the researcher assigned a single mean fidelity score to each participant; however, some participants received the same score but varied in their implementation of one accommodation to another. Therefore, the aggregation of FOI scores did not reflect the significance of individual predictor variables.

Recommendations for Future Research

The findings of this study suggest that teacher fidelity in the implementation of accommodations for students with SLD in mathematics should be further examined. Future research should include larger sample sizes of students with SLD in mathematics in each group. Replication of the study should be conducted with a variety of Algebra 1 concepts in order to establish external validity. In addition, researchers need to present sub-scores on important but significantly different components of fidelity (Mowbray et al., 2003). More precise fidelity scores may be obtained in the future by examining the quality of instruction in addition to examining the number of occurrences or components of accommodations that are implemented.

Unlike the current ex post facto study, a true experimental study should be conducted in which the experimental group of teachers receive specific training in various aspects of implementation of accommodations while the control group should not receive specific training in this area. The control group should still be assessed on their use accommodations without the benefit of the specific training. Student outcomes for both groups should be analyzed for both groups after a specified period of time. In the future also, qualitative data should also be collected for the study on how general education teacher feel about using specific accommodations and how students view their teachers' use of instructional accommodations.

Future research should also qualitatively examine the outcomes of methods courses taken by teachers while in college to the number and quality of instructional practices or accommodations that are used by general educators who teach students with

SLD as general education teachers are as critical to the education of students with SLD as special education teachers.

Implications

Student learning is a function of not only what is taught but how well it is taught (Harn et al., 2013). This study contributed to the literature in special education in three ways by: (a) addressing age-appropriate Algebra 1 content for high school students with SLD in mathematics, (b) highlighting interventions that are affordable and feasible for teachers to implement and (c) assessing the blending of special education instructional practices with the Florida State Standards in Algebra 1 in the general education classroom. Blending of special education instructional practices is critical as more students with SLD are included in general education classrooms (Strickland & Maccini, 2012).

As students with SLD in mathematics continue to be placed in general education classes, general education teachers play a major role in educating these students. A critical issue uncovered by the researcher was that many of the teachers in the study reported that although they were aware of most of the accommodations on the survey that they implemented, they were unsure about whether they were interpreting and implementing these accommodations adequately and efficiently. The teachers expressed concern that they were not specifically trained in how to implement the accommodations. As such, college methods courses for all pre-service teacher training should include ample training in blending instructional methods for teaching students with SLD with the age appropriate curriculum materials and accommodations while using resources that are easily accessible and affordable.

In addition, school administrators should take into consideration teacher training or expertise in instructing students with SLD when assigning these students to general education classes. If this is not taken into consideration prior to placing these students into general education classes, administrators should ensure that these general education teachers receive the necessary training and support them. Support can be done by making the necessary provisions for training either during monthly Early-Release Teacher Professional half days or on Teacher Planning Days. If possible, at least one day of mandatory training should also be implemented at the site or district level for all general education teachers with students with SLD. Training should be content specific in order to give these teachers a realistic hands-on approach to this blended instructional approach. In addition, special education chairpersons and/or program specialists need to become more actively involved in the placement and retaining of students with SLD in general education classes by making placement recommendations. In addition, they should work more closely with general education teachers in order to provide the necessary support and training needed. Finally, all general education teachers who do not have the benefit of a special education co-teacher working directly with them should actively collaborate with special education professionals for assistance, advice and support on planning and implementing instructional accommodations for students with SLD. According to Lusk, Thompson and Daane (2008), research shows that students with disabilities can make significant academic gains when general and special education teachers collaborate effectively.

Summary

Although the results of the study showed a statistical significance between teacher FOI of accommodations and student outcomes, replication of this study is critical in order to establish external validity; therefore, no definitive conclusions may be drawn. The favorable findings were that teachers with higher fidelity scores had greater student achievement and teachers in co-teaching settings had higher fidelity scores. The study also revealed that teachers who responded to the survey were willing to share their best practices used in their classes with students with SLD in mathematics and they expressed their willingness to receive training on the implementation of instructional accommodations for students with SLD in mathematics.

In addition to these findings, although one might assume that the more teaching experience that a teacher has this would yield higher fidelity scores, the data collected on teacher characteristics, such as teaching experience and levels of mathematics certification did not indicate this. In order to achieve high fidelity in the use instructional accommodations, a lot of time, effort and professional development opportunities are required in order to train teachers how to implement evidence-based instructional interventions. Improving student outcomes in mathematics is possible when scientifically based instructional strategies are used with fidelity.

No identified research has been conducted on the relationship between teacher FOI of accommodations for students with SLD in general education mathematics classes and student mathematics achievement; therefore, the findings of this study will add to the limited body of knowledge concerning how teacher FOI of interventions is predictive of student achievement in mathematics.

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APPENDICES

APPENDIX A

Survey Questionnaire

Survey of Teacher Use of Accommodations

(STUA)

Survey of Teacher Use of Accommodations

Date ______________________________

School Code ______________________

Teacher's Name: ____

Area(s) of Teacher Certification: ❑ Middle Grade Mathematics (5-9) ❑ Mathematics (6-12)

❑ Exceptional Student Education (K-12) ❑ Other ______________________________________

Please check if you teach following grade level and the course:

❑ 9th **❑ Algebra 1**

If you checked both boxes above, continue by checking the average number of students with specific learning disabilities in each of the mathematics classes you teach.

❑ 0-2 **❑ 1-2** **❑ 3>**

Please check the following accommodations that you use in your mathematics classes. You may use the extra lines to write in additional accommodations you use in your classroom.

Instructional Methodology and Materials

❑Provide assistance with note taking – copy of notes, outline, note taker

❑Provide concrete objects, pictures, graphics

❑Provide advanced organizers e.g. Study guides/ guided notes

❑Provide adapted materials - uncluttered, fewer items, highlighted/color coded

❑Provide sample problems of varying levels

❑Other ____

❑Other ____

Class Assignments and Assessments

❑Provide guides or prompts, personal assistance – e.g. teacher, peer, volunteer, aide

❑Break assignments into small segments

❑Provide extended access to instructional resources and equipment – e.g. access to math related computer activities or other related media

❑Other
____

❑Other
____

Learning/ Classroom Environment

❑Provide preferential seating (specify) e.g. near to teacher or with a peer/volunteer/aide______________

❑Provide a study carrel____

❑Provide instruction in small groups instruction or one-to-one with peer/volunteer/aide

❑Provide in-class assistance with organization

❑Other
____

❑Other
____

Time Demands and Schedules

❑Provide additional time to complete class assignments/class projects

❑Assign fewer questions to be completed in class/home

❑Independent or work groups in short time segments

❑ Other
____

❑Other
____

Please include any additional information on accommodations you use in your classroom

Appendix B

Teacher Accommodations Fidelity Observation Checklist

and

Teacher Accommodations Fidelity Observation Criteria for Scoring

Teacher Accommodations Fidelity Observation Checklist

School: _______________ Teacher: ______ Observer: ___________________________

		Date & Time			
Item	**Scoring Criteria**				
	Instructional Methodology and Materials Items (1-5)	**Score**			
1. Provide assistance with note taking – copy of notes, outline, note taker	0=No assistance provided with note taking – no copy of notes, outlines or note taker. 1= Provides assistance with at least **one** of these items. 2= Provides assistance with at least **two or more** of these items.				
2. Provide concrete objects, pictures, graphics	0=No concrete objects, pictures or graphics provided. 1=Provides at least **one** concrete object, picture or graphic. 2=Provides **two or more** concrete objects, pictures or graphics.				

3. Provide advanced organizers e.g. Study guides/ guided notes	0=No advanced organizer provided – no study guides/no guided notes. 1= Provides at least **one** advanced organizer – study guide/guided notes. 2= Provides **two or more** advanced organizers – e.g. study guide/guided notes.				
4. Provide adapted materials - uncluttered, fewer items, highlighted	0=No adapted materials provided – several cluttered items, no highlighting/color coding. 1=Provides fewer/uncluttered/highlighted items. 2=Provides fewer, uncluttered, highlighted items				
5. Provide sample problems of varying complexity	0=No sample problems provided. 1=Provides **one** sample problems. 2=Provides **two or more** sample problems.				
	Class Assignments and Assessments Items (6-8)	**Score**			
6. Provide personal assistance – e.g. teacher, peer or volunteer assistance	0= No personal assistance provided. 1=Provides at least **one** form of teacher/peer or volunteer assistance. 2= Provides at least **two or more** forms of teacher/peer or volunteer assistance.				

7. Provide guides or prompts for specific tasks – e.g. sample problems of varying complexity, breaks assignments into small segments	0=No guides or prompts for specific tasks provided. 1=Provides a guide or prompt for specific tasks – e.g. sample problems of varying complexity **or** breaks assignments into small segments. 2= Provides at least guide or prompt for specific tasks – e.g. sample problems of varying complexity **and** breaks assignments into small segments.				
8. Provide extended access to instructional resources and equipment – e.g. access to math related computer activities, calculators or other related media	0=No access to instructional resources and equipment provided. 1=Provides limited access to **one** math related computer activities, calculator or other related media. 2=Provides extended access to **more than one** math related computer activities, calculators or other related media.				
	Learning/ Classroom Environment Items (9-12)	**Score**			
9. Provide preferential seating e.g. near to teacher or with a peer/volunteer/aid	0=No preferential seating provided. 1=Provides preferential seating near to teacher. 2=Provides preferential seating teacher and a peer or volunteer.				
10. Provide instruction in small groups instruction or one-to-one with peer/volunteer/aid	0=Provides no small group or one-to-one instruction. 1=Provides small group **or** one-to-one instruction with peer/volunteer/aid 2= Provides small group **and** one-to-one instruction with				

	peer/volunteer/aid				
11. Provide in-class assistance with organization e.g. organizing notebook, classwork	0=Provides no assistance with organization. 1=Provides assistance with organizing notebook **or** classwork. 2= Provides assistance with organizing notebook **and** classwork.				
12. Provide a study carrel	0=Provides no study carrel. 1=Provides at least one study carrel. 2= Provides more than one study carrel.				
	Time Demands and Schedules Items (13-15)	**Score**			
13. Provide additional time to complete class assignments/class projects	0=Provides no additional time to complete class assignments/class projects. 1=Provides limited additional time to complete class assignments/class projects. 2= Provides ample additional time to complete class assignments/class projects				

14. Assign fewer questions to be completed in class/home	0=Does not assign fewer questions to be completed. 1= Assign fewer questions to be completed in class **or** home. 2= Assign fewer questions to be completed in class **and** home.				
15. Provide for independent or work groups in short time segments	0=Does not provide for independent work or work groups in short segments. 1= Provides for independent work **or** work groups in short segments. 2= Provides for independent work **and** work groups in short segments.				

Notes

Teacher Accommodations Fidelity Observation Scoring Criteria

Item	Scoring Criterion
	Instructional Methodology and Materials Items (1-5)
1. Provide assistance with note taking – copy of notes, outline, notetaker.	0=No assistance provided with note taking – no copy of notes, outlines or note taker. 1= Provides assistance with at least **one** of these items. 2= Provides assistance with at least **two or more** of these items.
2. Provide concrete objects, pictures, graphics.	0= No concrete objects, pictures or graphics provided. 1=Provides at least **one** concrete object, picture or graphic. 2=Provides **two or more** concrete objects, pictures or graphics.
3. Provide advanced organizers e.g. Study guides/ guided notes.	0= No advanced organizer provided – no study guides/no guided notes. 1= Provides at least **one** advanced organizer – study guide/guided notes. 2= Provides **two or more** advanced organizers – e.g. study guide/guided notes.
4. Provide adapted materials - uncluttered, fewer items, highlighted.	0=No adapted materials provided – several cluttered items, no highlighting/color coding. 1=Provides fewer/uncluttered/highlighted items. 2=Provides fewer, uncluttered, highlighted.
5. Provide sample problems of varying complexity.	0=No sample problems provided. 1=Provides **one** sample problems. 2=Provides **two or more** sample problems.

	Class Assignments and Assessments Items (6-8)
6. Provide personal assistance – e.g. teacher, peer or volunteer assistance.	0=No personal assistance provided. 1=Provides at least **one** form of teacher/peer or volunteer assistance. 2= Provides at least **two or more** forms of teacher/peer or volunteer assistance.
7**.** Provide guides or prompts for specific tasks – e.g. sample problems of varying complexity, breaks assignments into small segments.	0=No guides or prompts for specific tasks provided. 1=Provides a guide or prompt for specific tasks – e.g. sample problems of varying complexity **or** breaks assignments into small segments. 2= Provides at least guide or prompt for specific tasks – e.g. sample problems of varying complexity **and** breaks assignments into small segments.
8**.** Provide extended access to instructional resources and equipment – e.g., access to math related computer activities, calculators or other related media.	0=No access to instructional resources and equipment provided. 1=Provides limited access to **one** math related computer activities, calculator or other related media. 2=Provides extended access to **more than one** math related computer activities, calculators or other related media.
	Learning/ Classroom Environment Items (9-12)
9. Provide preferential seating e.g. near to teacher or with a peer/volunteer/aide.	0=No preferential seating provided. 1=Provides preferential seating near to teacher. 2=Provides preferential seating teacher and a peer or volunteer.
10. Provide instruction in small groups instruction or one-to-one with peer/volunteer/aide.	0=Provides no small group or one-to-one instruction. 1=Provides small group **or** one-to-one instruction with peer/volunteer/aid. 2= Provides small group **and** one-to-one instruction with peer/volunteer/aid.

11. Provide in-class assistance with organization.	0=Provides no assistance with organization. 1=Provides assistance with organizing notebook **or** classwork. 2= Provides assistance with organizing notebook **and** classwork.
	Time Demands and Schedules Items (13-15)
13. Provide additional time to complete class assignments/class projects.	0=Provides no additional time to complete class assignments/class projects. 1=Provides limited additional time to complete class assignments/class projects. 2= Provides ample additional time to complete class assignments/class projects.
14. Assign fewer questions to be completed in class/home.	0=Does not assign fewer questions to be completed. 1= Assign fewer questions to be completed in class **or** home. 2= Assign fewer questions to be completed in class **and** home.
15. Provide for independent or work groups in short time segments.	0=Does not provide for independent work or work groups in short segments. 1= Provides for independent work **or** work groups in short segments. 2= Provides for independent work **and** work groups in short segments.

Appendix C

Table of Specifications for Expert Judging

Table of Specifications for Expert Judging

Accommodations Implementation

Items	Instructional Methodology and Materials	Class Assignments and Assessments	Learning/ Classroom Environment	Time Demands and Schedules
Provides assistance with note taking				
Provides concrete objects, pictures, graphics				
Provides advanced organizers				
Provides adapted materials				
Provide sample problems of varying levels				
Provides guides or prompts, personal assistance				
Break assignments into small segments				
Provides extended access to instructional resources and equipment				

Provides preferential seating				
Provide a study carrel				
Provides instruction in small groups instruction or one-to-one				
Provides in-class assistance with organization				
Provides additional time to complete class assignments/class projects				
Assign fewer questions to be completed in class/home				
Independent or work groups in short time segments				
Tally of Checkmarks; Sufficient? Yes/No				

Please provide written feedback for columns 1-4

Feedback for Column 1	Feedback for Column 2	Feedback for Column 3	Feedback for Column 4	Additional Feedback

Appendix D

Table of Specifications

Researcher's Compilation Form

Accommodations Implementation

Table of Specifications Compiling Form

Items	**Instructional Methodology and Materials**	**Class Assignments and Assessments**	**Learning/ Classroom Environment**	**Time Demands and Schedules**	**% Agreement of Average of all Judges**
Provides assistance with note taking					
Provides concrete objects, pictures, graphics					
Provides advanced organizers					
Provides adapted materials					
Provide sample problems of varying levels					
Provides guides or prompts, personal assistance					
Break assignments					

into small segments					
Provides extended access to instructional resources and equipment					
Provides preferential seating					
Provide a study carrel					
Provides instruction in small groups instruction or one-to-one					
Provides in-class assistance with organization					
Provides additional time to complete class assignments/ class projects					
Assign fewer					

questions to be completed in class/home					
Independent or work groups in short time segments					
Tally of Checkmarks; Sufficient? Yes/No					
% to which the item estimates the concept:					

Please provide written feedback for columns 1-4

Feedback for Column 1	Feedback for Column 2	Feedback for Column 3	Feedback for Column 4	Additional Feedback	

APPENDIX E

ADULT CONSENT FORMS

ADULT ONLINE CONSENT TO PARTICIPATE IN A RESEARCH STUDY

Title: EXAMINING THE RELATIONSHIP BETWEEN FIDELITY OF IMPLEMENTATION OF ACCOMMODATIONS FOR STUDENTS WITH SPECIFIC LEARNING DISABILITIES AND STUDENT MATHEMATIC ACHIEVEMENT IN NINTH GRADE INCLUSION MATHEMATICS CLASSES.

You are being asked to be in a research study. The investigator of this study is Belinda B. Baptiste, a doctoral student at Florida International University. The study explores the relationship of the use of specific instructional accommodations and student outcomes, particularly in mathematics at the secondary level for students with specific learning disabilities (SLD) in the ninth grade general education classrooms. The study will include general education mathematics teachers in Miami-Dade County Public Schools who have students with specific learning disabilities (SLD) in their classrooms. During Phase I of the study you will be asked to respond to a survey on the instructional accommodations you use in your mathematics classrooms in which there are students with specific learning disabilities. If your responses to the questionnaire meet the criteria for selection for the other phases of the study you will be contacted and informed of this by the researcher.

If you are selected and agree to be part of the other phases of the study, you will be observed over a 3-week period for 1 ½ to 2 hours each week (one observation per week) for a total of three observations and the researcher will be collecting data on the implementation of mathematics instructional accommodations in the general education classroom and student achievement on an Algebra 1 Topic test. You will be asked to do the following things:

a. Meet with the researcher for a brief information session prior to being observed at a time convenient to you in order to provide more clarifying details of the study.
b. Administer one of Miami-Dade County School District's Algebra 1 Topic Test to the entire class during the period of the study as a pre-and post-test (the test will be provided for pre-testing prior to the topic being taught) and provide the researcher with the tests data.
c. Allow the researcher 3 in-class observations in one of your Algebra 1 classes with at least three students with Specific learning disabilities (SLD). The observation will be for approximately 1 ½ to 2hours (one class period) on 3 separate occasions over a 3-week period (the observer will use a checklist containing instructional accommodations).

The data collected will be identified by numbers and letters of the alphabet only and not your name or the name of your school. The data will also be presented on a graph and table. The research will be conducted within a commonly accepted educational setting (your classroom) and will not deviate substantially from normal educational practices. The research will be conducted with adult participants only. Furthermore, although maximum efforts will be taken to respect the privacy of the participant, disclosure of participant's responses outside the research would not reasonably place participant at risk of criminal or civil liability or be damaging to participant's financial standing, employability, or reputation. The records of this study will be kept private and will be protected to the fullest extent provided by law. In any sort of report we might publish, we will not include any information that will make it possible to identify a subject. Research records will be stored securely and only the researcher team will have access to the records. However, your records may be reviewed for audit purposes by authorized University or other agents who will be bound by the same provisions of confidentiality.

It is expected that this study will benefit society because it will fill the gap in the research on academic accommodations for students with specific learning disabilities in mathematics in general education classrooms. This information will add to the body of knowledge on best practices in mathematics instruction. Participants will also have the opportunity to reflect on their own best practices.

There is **no cost to you**. You will receive a gift card in the amount of **$20.00** for each in-class observation and the gift card will be given to you at the end of the study. You will not be responsible for any costs to participate in this study.

Your participation in this study is voluntary. You are free to participate in the study or withdraw your consent at any time during the study. Your withdrawal or lack of participation will not affect any benefits to which you are otherwise entitled. The investigator reserves the right to remove you without your consent at such time that they feel it is in the best interest.

If you have any questions about the purpose, procedures, or any other issues relating to this research study you may contact Belinda B. Baptiste at 954-736-0828, Baptiste_B@comcast.net.

If you would like to talk with someone about your rights of being a subject in this research study or about ethical issues with this research study, you may contact the FIU Office of Research Integrity by phone at 305-348-2494 or by email at ori@fiu.edu.

I have read the information in this consent form and agree to participate in this study. I have had a chance to ask any questions I have about this study, and they have been answered for me. I understand that I will be given a copy of this form for my records.

(Insert Consent to Participate Button Here on the Website)

CONSENT TO PARTICIPATE IN A RESEARCH STUDY

Title: EXAMINING THE RELATIONSHIP BETWEEN FIDELITY OF IMPLEMENTATION OF ACCOMMODATIONS FOR STUDENTS WITH SPECIFIC LEARNING DISABILITIES AND STUDENT MATHEMATICS ACHIEVEMENT IN NINTH GRADE INCLUSION MATHEMATICS CLASSES

You are being asked to be in a research study. The investigator of this study is Belinda B. Baptiste and she is a doctoral student at Florida International University. The study will include nine general education teachers who have at least three students with specific learning disabilities (SLD) in at least one of their mathematics classrooms. The study will consist of three 1 ½ to 2 hour classroom observations for a 3-week period. The study explores the relationship of the use of specific instructional accommodations and student outcomes, particularly in mathematics at the secondary level for students with specific learning disabilities (SLD) in the ninth grade general education classrooms.

If you agree to be part of the study, you will be observed over a 3-week period and the researcher will be collecting data on the implementation of mathematics instructional accommodations in the general education classroom and student achievement on an Algebra 1 Topic test. You will be asked to do the following things:

d. Meet with the researcher for a brief information session prior to being observed at a time convenient to you in order to provide more clarifying details of the study.
e. Administer one of Miami-Dade County School District's Algebra 1 Topic Test to the entire class during the period of the study as a pre-and post-test (the test will be provided for pre-testing prior to the topic being taught) and provide the researcher with the tests data.
f. Allow the researcher 3 in-class observations in one of your Algebra 1 classes with at least three students with Specific learning disabilities (SLD). The observation will be for approximately 1.5 hours to 2hours (1 class period) on 3 separate occasions over a 3-week period (the observer will use a checklist containing instructional accommodations).

The data collected will be identified by numbers and letters of the alphabet only and not your name or the name of your school. The data will also be presented on a graph and table. The research will be conducted within a commonly accepted educational setting (your classroom) and will not deviate substantially from normal educational practices. The research will be conducted with adult participants only. Furthermore, although maximum efforts will be taken to respect the privacy of the participant, disclosure of participant's responses outside the research would not

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reasonably place participant at risk of criminal or civil liability or be damaging to participant's financial standing, employability, or reputation. The records of this study will be kept private and will be protected to the fullest extent provided by law. In any sort of report we might publish, we will not include any information that will make it possible to identify a subject. Research records will be stored securely and only the researcher team will have access to the records. However, your records may be reviewed for audit purposes by authorized University or other agents who will be bound by the same provisions of confidentiality.

It is expected that this study will benefit society because it will fill the gap in the research on academic accommodations for students with specific learning disabilities in mathematics in general education classrooms. This information will add to the body of knowledge on best practices in mathematics instruction. Participants will also have the opportunity to reflect on their own best practices.

There is **no cost to you**. You will receive a gift card in the amount of **$10.00** for each in-class observation and the gift card will be given to you at the end of the study. You will not be responsible for any costs to participate in this study.

Your participation in this study is voluntary. You are free to participate in the study or withdraw your consent at any time during the study. Your withdrawal or lack of participation will not affect any benefits to which you are otherwise entitled. The investigator reserves the right to remove you without your consent at such time that they feel it is in the best interest.

If you have any questions about the purpose, procedures, or any other issues relating to this research study you may contact Belinda B. Baptiste at 954-736-0828, Baptiste_B@comcast.net.

If you would like to talk with someone about your rights of being a subject in this research study or about ethical issues with this research study, you may contact the FIU Office of Research Integrity by phone at 305-348-2494 or by email at ori@fiu.edu.

I have read the information in this consent form and agree to participate in this study. I have had a chance to ask any questions I have about this study, and they have been answered for me. I understand that I will be given a copy of this form for my records.

_________________________________ ___________________

Signature of Participant Date

____

Printed Name of Participant

_________________________________ ___________________

Signature of Person Obtaining Consent Date

APPENDIX F

ALGEBRA 1 TEST

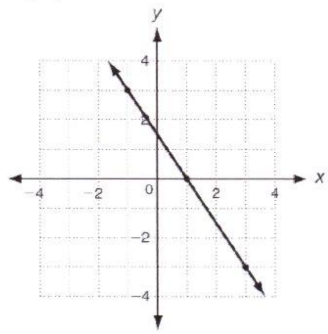
Name ________________________ Date ______________ Class ______________

UNIT 3

Linear Functions, Equations, and Inequalities

Unit Test: A

1. What are the *x*- and *y*-intercepts of the line graphed below?



____

2. What are the slope and *y*-intercept of the line described by $y = 3x - 6$?

____

3. Which of these shows $y = 2x + 1$ in point-slope form?

   A $y - 2x = 1$

   B $y - 3 = 2(x - 1)$

   C $2x - y = -1$

   D $y = x + \frac{1}{2}$

4. Evaluate the statements below for $f(x) = 4x$, $g(x) = -4x$, and $h(x) = \frac{1}{4}x$.

   A The line for $f(x)$ is steeper than the line for $h(x)$.

   O True O False

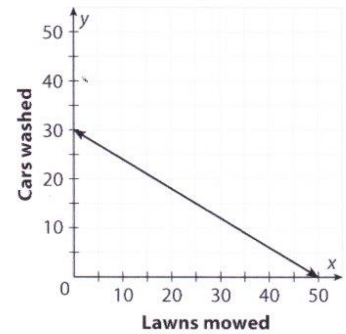
   B The line for $f(x)$ goes down and to the right.

   O True O False

   C The line for $g(x)$ goes down and to the right.

   O True O False

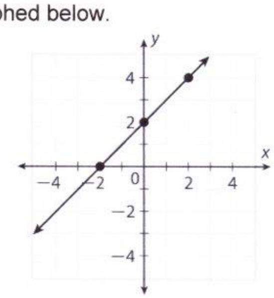
5. Kurt does chores in his neighborhood. The graph shows Kurt's savings goal for the summer. If he washes 15 cars, how many lawns will he have to mow to meet his goal?



   A 15 C 30

   B 25 D 50

6. The function $f(x)$ has slope 3 and *y*-intercept −2. The function $g(x)$ is graphed below.



How does the rate of change of $f(x)$ compare to the rate of change of $g(x)$?

____

7. Leslie joins a fitness club that has an initial fee of $20 plus a monthly fee of $15. Rashad's club charges $40 initially plus $10 per month. In how many months will the clubs cost the same?

____

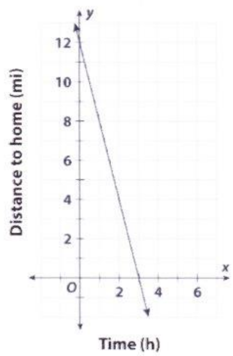
Name ______________________________ Date ________________ Class ________________

UNIT 3

Linear Functions, Equations, and Inequalities

Unit Test: A

8. Opal walked from school to home, which was a distance of 12 miles. She walked at a rate of 4 miles per hour. The graph represents the remaining distance Opal had to walk.



a. Find the slope of the line.

____

b. Find the *x*-intercept, and explain what it represents in the context.

____

c. Find and interpret the *y*-intercept.

____

d. Write an equation for the line in slope-intercept form.

____

9. An accountant charges an initial fee of \$100 plus a rate of \$40 per hour. The function that shows the total fees charged is $f(x) = 40x + 100$. How would the graph of the function change if the accountant raised his rate to \$45 per hour?

____

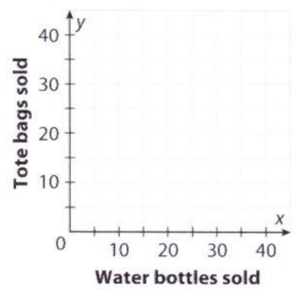
10. a. The Environmental Club is selling water bottles for \$8 and tote bags for \$12 to raise \$240 to donate to charity. Write the linear equation for the fundraising goal.

____

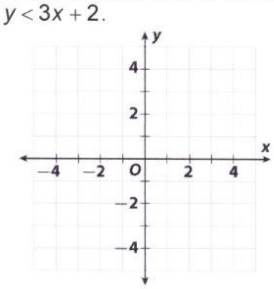
b. Complete the table.

Water Bottles	Tote Bags
0	
	0
15	

c. Graph the equation.



11. a. Graph the solutions to the inequality $y < 3x + 2$.



b. List two ordered pairs that are solutions to the inequality and two ordered pairs that are not solutions.

Solutions: ______________________________

Nonsolutions: ______________________________

VITA

BELINDA B. BAPTISTE

Born, Glencoe, Trinidad, W.I.

1995	M.S., Special Education Teacher Florida International University Miami, FL
1995 – 2010	Special Education Teacher Miami-Dade County Public Schools Miami, FL
2011 – 2013	General Education Mathematics Teacher Miami-Dade County Public Schools Miami, FL
2011 – Present	Member of Project EDUCATE Cohort Florida International University Miami, FL
2013 – Present	Mathematics Coach Miami-Dade County Public Schools Miami, FL
2011 – 2017	Doctoral Candidate Florida International University Miami, FL

PRESENTATIONS

Council for Exceptional Children – Teacher Education Division (Lexington, KY; November, 2016). “Professional Development Needs of Special Educators to Fully Implement the Mathematics and Language Arts Standards for Students with Disabilities.”