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Effects of SuccessMakers Math as an Intervention for Students

Jennifer Lee Calcut
Walden University

Walden University

College of Social and Behavioral Sciences

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Jennifer Calcut

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Review Committee
Dr. Timothy Lionetti, Committee Chairperson, Psychology Faculty
Dr. Arcella Trimble, Committee Member, Psychology Faculty
Dr. Patricia Heisser-Metoyer, University Reviewer, Psychology Faculty

Chief Academic Officer
Eric Riedel, Ph.D.

Walden University
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Abstract

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MA, Utah State University, 1998

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Dissertation Submitted in Partial Fulfillment

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Doctor of Philosophy

School Psychology

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Abstract

Schools throughout the United States use the IQ-achievement discrepancy method to identify children with learning disabilities. This current method allows many students to fall behind in the regular education setting. In 2004, the Individuals with Disabilities Education Act was reauthorized to provide states with the option of using a response to intervention (RtI) model in lieu of or in conjunction with the IQ-achievement discrepancy model. The purpose of this quasi-experimental, single subject, pre/posttest design study was to determine the impact of a Tier II intervention using SuccesMakers Math, a learning system that adapts to the unique needs of the individual student, for students in Grade 5 who were identified as at risk for math failure. Ten students who met these inclusion criteria completed 4 weeks of intervention daily for 30 minutes using SuccessMakers Math. A paired *t* test was conducted using pre/post-test Star Math scores and revealed a significant increase in math scores for participants ($t(9) = 4.690$, $p = .001$) before and after the RtI model. This research could inform educational leaders' efforts to improve student skills in mathematics through an effective Tier II math intervention.

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Dedication

I would like to take this opportunity to dedicate and thank the many people in my life who have helped me through this process.

First, I would like to thank my wonderful, supportive husband who encouraged me every step of the way. Without him, I would not have found the determination, confidence or strength I needed to even begin this journey. I am so grateful that he believed in my ability to accomplish this seemingly daunting task.

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Chapter 1: Introduction to the Study

Background of Problem

Educators have long been troubled by the practices surrounding the education of students with disabilities. It was not until 1965 that federal legislation was passed that related directly to children and youth with disabilities. Until that time, students with disabilities were excluded from attending a public school setting. The Elementary and Secondary Education Act (ESEA, 1965) Amendments was the first piece of legislation that addressed educating children with disabilities. This piece of legislation granted monies to state institutions and schools devoted to educating children with disabilities. However, the schools serving students with disabilities still segregated them from the public school population.

The ESEA (1966) set forth a federal grant program that offers education to children and youth with disabilities at a local school level. It also includes a provision that allowed for the development of the Bureau of Education of the Handicapped (BEH) as well as the National Advisory Council. In 1970, the ESEA established a grant program that was referred to as Part B, which authorized core grant programs to local education agencies (ESEA, 1970). This was the beginning of the funding for special education services for people with disabilities.

The Education for All Handicapped Children Act (EAHCA, 1975) was enacted in order to provide a free and appropriate public education to children ages 3–21 who had been identified as disabled. In 1976, a year after the act was enacted, data collection began to monitor schools' compliance with the law. At that time the number of children

that were identified as receiving special education was 3.7 million, which accounted for 8% of the student population; that number had grown to 6.7 million or 14 % of the population by 2007 as a result of the IQ-achievement discrepancy model (Aud et al., 2010).

The IQ-achievement discrepancy model was developed in 1975 as part of a federally mandated program that would identify students with a learning disability under the EAHCA. The theory for the IQ-achievement discrepancy model is based on the assumption that "intelligence predicts achievement, intelligence is a static characteristic, and intelligence serves as a measure of learning capacity" (O'Malley et al., 2002, p. 32). According to the IQ achievement discrepancy model, a child's IQ and achievement scores should be commensurate. A child, therefore, should perform academically to their cognitive ability. Since the passing of the EAHCA, the IQ-achievement discrepancy model has been the predominant model for identifying students with learning disabilities (LD) in the United States. In recent years however, this model has become a controversial issue in education because it may have led to the over identification of children with learning disabilities (Machek & Nelson, 2007). Since 1980, the increase in children being identified as having a specific LD has increased more than any other disability (Aud et al., 2010). In 2007–2008 an estimated 39% of all children receiving services under the Individuals with Disabilities Education Act (IDEA) had a specific LD (Aud et al., 2010). The over-identification of children with learning disabilities has led researchers to believe that children are often misplaced in academic settings and has been a pivotal piece in the research that will be discussed further supporting the use of a Response to Intervention

(RtI) model to aid educators in determining proper placement and interventions for children who are struggling to make academic gains.

Many researchers have argued that IQ is the most critical aspect of identifying children with LD (Johnson, Mellard, & Byrd, 2005; Kavale, 2005) while others have suggested that IQ is just a small piece of the puzzle and more focus should be placed on dynamic assessments and responsiveness to intervention (Cooter & Cooter, 2004; Fletcher, Francis, Morris, & Lyon, 2004; Fuchs et al. 2003; National Joint Committee on Learning Disabilities, 2005). As a result of the rising identification of children with LD, the Office of Special Education Programs in the U.S. Department of Education began the process of looking at alternative methods for the determination of eligibility for special education for students with a specific LD (Fuchs, Fuchs, & Hollenbeck 2007).

The President's Commission on Excellence in Special Education was created to report on all the issues relating to special education and then give recommendations for improving instruction to students with disabilities (Brown-Chidsey & Steege 2010). The report, A New Era: Revitalizing Special Education for Children and their Families, was published in July of 2002 (President's Commission on Excellence in Special Education [PCESE], 2002). The findings from this report were the beginning for the RtI movement in both general and special education and stressed the importance of early intervention for struggling students. It stated:

> The current system uses an antiquated model that waits for a child to fail, instead of a model based on prevention and intervention. Too little emphasis is put on prevention, leading to students with disabilities not obtaining interventions early

> on when that help can be most effective. Special education should be for those who do not respond to specific and appropriate instruction and methods provided in the general educations. (PCESE, 2002, p. 7)

This report was the stimulus for the ensuing changes in 2004 following President George W. Bush's signing the reauthorization of the IDEA that stated:

> A state must adopt, consistent with 34 CFR 300.309, criteria for determining whether a child has a specific learning disability as defined in 34 CFR 300.8(c)(10). In addition, the criteria adopted by the State: 1) Must not require the use of a severe discrepancy between intellectual ability and achievement for determining whether a child has a specific learning disability, as defined in 34 CFR 300.8(c)(10); 2) Must permit the use of a process based on the child's response to scientific, research-based intervention; and 3)May permit the use of other alternative research-based procedures for determining whether a child has a specific learning disability, as defined in 34 CFR 300.8(c)(10). (U.S. Department of Education, 2008, ¶2)

After this reauthorization, school systems across the United States began implementing an RtI model in lieu of or in conjunction with the IQ-achievement discrepancy model. The formalization of RtI placed into law allowed educators to put equal weight into the prevention of academic difficulties for struggling students (Fuchs et al., 2010).

Not only does IDEA address the concept of RtI, but so does the No Child Left Behind Act (NCLB), which is the most recent version of the Elementary and Secondary

Education Act (ESEA). NCLB requires schools to identify students who are falling behind academically and deemed at risk for academic failure. The school must then provide a scientifically-proven, peer reviewed intervention program that will address the student's needs (NCLB, 2001, 2002). NCLB seeks to expand educational outcomes for disadvantaged students by closing the achievement gap between a variety of subgroups of students, including those with disabilities. RtI is a model that allows for early intervention to struggling students that may increase their chances of being successful in general education. NCLB also set forth new requirements for academic standards, which includes a 2013–2014 deadline for all public schools to ensure that all students will be proficient in reading and math (Yell, Shriner, & Katsiyannis 2006).

Problem Statement

In recent years it has come to the attention of researchers that there is a problem in the U. S. public education system with the use of the IQ-achievement discrepancy model to identify children with a LD (Fletcher, Coulter, Reschly, & Vaughn, 2004). According to the IQ-achievement discrepancy model, a child is considered to have a LD and provided with learning interventions if standardized testing reveals a significant discrepancy between intelligence and achievement skills (O'Malley et al., 2002). As a result of this model, when a LD is identified, the child qualifies to receive specialized instruction to increase achievement. Researchers have suggested that the IQ-achievement discrepancy model is ineffective and have proposed that all school systems adopt a new model for identifying students that are at risk for failure, as well as decrease the rate of

identification of children with LD (Fletcher et al, 2005; Fuchs et al, 2003; Stage et al., 2003; Stanovich, 2005).

Much of the current research available about students with a LD is about instructional methods and materials that have proven to be successful in assisting these students learn critical skills prior to age 10 (Blachman et al., 2004; Schatchneider, Francis, Carlson, Fletcher, & Foorman, 2004). This research is consistent with the movement within the field of special education that supports the RtI model as discussed in the Reauthorization of IDEA (2004).

The RtI model has historical roots within the field of education dating back more than three decades, with the work of Deno in the 1970s and serves as the theory for this study. RtI has been examined in all areas of academics; however, the most concentrated research has been in the area of reading (Gersten, & Newman-Gonchar, 2011). In the past few years, however, RtI has become a focus of educators in the area of mathematics, focusing on the importance of effective instruction that allows for struggling students to learn mathematical computations, applications, and concepts (Gersten & Newman-Gonchar, 2011).

Mathematics education came to the forefront when President George W. Bush reinstated NCLB (2002) to focus on higher accountability for educators to prepare students in reading and math in Grades 3 through 8. In recent years, RtI has been introduced into mathematics instruction as a result of the low achievement levels in mathematics by students across the United States (Gersten et al., 2009; National Mathematics Advisory Panel, 2008).

Data of U.S. struggles with mathematics are summarized in the National Assessment of Educational Progress (2011), which reported that only 40% of fourth grade students were performing at proficient or advanced levels in mathematics, and only 25% of eighth grade students achieved proficient or advanced levels in mathematics (Nation's Report Card, 2011). In the final report of the National Mathematics Advisory Panel (NMAP, 2008), 78% of adults cannot explain how to compute interest or monetary loans, 71% of adults cannot calculate the miles driven per gallon of gasoline used, and 58% of adults cannot calculate a 10% gratuity tip when dining out. In the nation, students continue to struggle to make academic gains in the area of mathematics and would benefit from early intervention in order to make adequate academic gains.

As a result of the low performance of U.S. students, President Bush appointed the Mathematics Advisory Panel to study this problem in 2006 and to produce a report with the findings and recommendations (U.S. Department of Education [USDOE], 2006). The findings and recommendations presented in March of 2008 by NMAP (USDOE, 2008) highlighted the following main points:

1. Math in the United States should be streamlined in the early grades.
2. Focus needs to be on the student's ability to build fluency in basic math facts.
3. Teachers need to have a strong mathematical knowledge.
4. Instructional practices should be research based.
5. State assessments need to drastically improve.
6. Research in the area of interventions and mathematics should continue. (NMAP, 2008, pp. xiii–xiv).

The panel also stressed the necessity for early learning to give students a strong base on which to build higher level math concepts. As a result of the need to improve math education for all students beginning in the first years of the student's education, in this study, I focused on children in the elementary school setting who struggle with mathematical concepts. Researchers who have studied RtI have been focused on reading; however, there is also a need for more researchers to examine appropriate intervention materials in mathematics. As a result, in this study, I focused on mathematic interventions for struggling students in a rural elementary setting within the western United States.

With approximately 5 to 10% of the school age population suffering from mathematics disabilities (MD), the field of research into mathematics and interventions needs to be improved (Fuchs et al., 2005). Currently, the supports for students in mathematics may be nonexistent in many schools across the United States. This lack of mathematics support may be a direct result of the limited body of research in the area of mathematics.

The purpose of this study was to examine the responsiveness of elementary-aged students without SLD, to interventions for mathematics. This study examined the effectiveness of a computer-based intervention program, Success Makers. I determined if this particular intervention strategy is successful for students who have been identified as at risk for math difficulties. It is important to address this gap in the research regarding mathematic interventions because students must possess mathematical skills in order to be successful in school, as well as after graduation. Without research addressing this gap,

students in the United States may continue to score below students in other nations in mathematics.

The study serves three purposes: (a) to aid in the research on appropriate Tier II interventions in mathematics, (b) to provide a tool for schools to guide instructional decision making in mathematics, and (c) to assist in monitoring students' mathematics progress.

Theoretical Framework

Deno's (1970) problem solving model provided the theoretical framework for this study. Deno's theory is based on the cascade of services model that was developed for special education in determining service delivery to students with disabilities. The model was used as the core framework for the implementation of special educations services during the 1970s and 1980s (Brown-Chidsey, Seppala, & Segura, 2000). Deno focused on implementing appropriate instruction that was based on the individual student's educational progress in the least restrictive environment. Deno's problem solving theory and model has been used by many educators across the United States to aid in the implementation of the RtI model. This model includes the following five stages:

1. Problem identification,
2. Problem definition,
3. Designing intervention plans,
4. Implementing the intervention and progress monitoring, and
5. Problem solution.

The first stage begins with the identification of problems for struggling students; this includes activities that are included throughout the student's academic career and can be accomplished by observing and recording the student's performance (Deno, 1970). The second stage, definition of the problem, requires educators to evaluate the nature and magnitude of the problem and then determine if an intervention is required (Deno, 1970). The third stage consists of designing intervention plans that allow for the implementation of specific activities or procedures to target the problem (Deno, 1970). Next, the fourth stage includes the implementation of the intervention and progress monitoring (Deno, 1970). This step in the model consists of two components: first, the intervention or implementation of the instruction and then data collection to determine the effectiveness of the intervention. This is completed through progress monitoring, which could consist of recording the frequency, accuracy, rate, duration, and intensity of the behavior or skill (Steege & Watson 2009). The fifth and final stage of the model is the problem solution phase; this allows for the recognition of success by examining the preset criteria and determining if the goals have been met (Brown-Chidsey & Steege.2010). Deno's model is organized in a way that can be used to solve a vast array of school problems (Brown-Chidsey, 2005; Deno,2002; Tilly, 2008). The strengths of using a problem solving model is that it allows for reporting of successes when certain criteria have been met, as well as addressing the needs of struggling students prior to allowing them to fail.

Additionally, the theory presented by Fuchs, Fuchs, and Speece (2002) of dual discrepancies also constitutes the theoretical framework for this study. According to the dual discrepancy theory, "when a low-performing child fails to manifest growth in a

situation where others are thriving, alternative instructional methods must be tested to address the apparent mismatch between the student's learning requirements and those represented in the conventional instructional program" (Fuchs et al., 2002, p. 35). This allows for an alternative model of instructional support for children who do not make progress that is commensurate with their peers, without comparing the individual's IQ relative to his or her achievement. In the past, IQ has not been confirmed as an accurate predictor of ability or achievement (Brown-Chidsey & Steege, 2005; Nelson & Machek, 2007; Vaughn & Fuchs, 2003). In the IQ discrepancy model, only students who struggled to learn were denied services based on eligibility for special education services. The RtI process seeks to solve that problem by allowing for schools to assess all students, provide instruction based on assessment results, analyze the student's progress, and provide instruction based on the assessment. This allows for educators to intervene with students who are struggling and provide intensive support for all students. Both the problem solving model and the dual discrepancies theory played roles in this study and will be referred to throughout this document.

Significance

This study has the potential to create social change in a number of ways. First, students in the United States need to improve their math abilities (Lemke & Gonzales, 2006). The NMAP (2008) indicated that schools need to have math instruction beginning in preschool through eighth grade that will prepare students for algebra at the high school level. The current research will help to prepare students who display an academic delay

in mathematics in an elementary school setting to enter a secondary setting with the mathematical skills necessary for success.

Next, this research will also assist with the determination of appropriate Tier II intervention programs that could be used in an RtI model. Many students have been unable to receive academic support that is commensurate with their needs because they have not qualified for support services based on the previous discrepancy models, or the student's needs were not specifically addressed (Allington, 1995; Fuchs & Fuchs, 2006; Fuchs et al., 2003). Contributing to this struggle is the notion that teachers have not always used universal screening instruments that have allowed for formative assessments that identify the student's weaknesses and allow for intervention strategies to be implemented that would enable the students to make progress (Nelson & Machek, 2007; Speece, Case, & Malloy, 2003). This research will aid in the support of a Tier 2 intervention program that would benefit specific groups of students that are at risk for failing in math.

Finally, the study is significant because the participants in the study used universal screening methods and curriculum-based measurements that determined the students' skill development in math. The data from the curriculum-based measurements were used to make instructional decisions to determine the students' interventions, thereby supporting the implementation of an RtI intervention program for mathematics.

Nature of the Study

In the study, the single-subject design was used to measure the impact of a Tier 2 mathematics intervention on mathematic skills with fifth grade students in an elementary

setting who were identified as at-risk for academic failure in mathematics through an RtI model in an urban community in the western region of the United States.

Research Question

Will the implementation of a Tier 2 math intervention, SuccessMakers, (independent variable) allow for growth in individual math skills (dependant variable) with a student that has been identified as struggling with math skills in order to be on grade level or within a year of grade level math skills?

Hypotheses

Ho1: SuccessMaker Mathematics will increase the students' math skills at a rate that would allow for them to attain grade level math skills.

Ho2: Successmaker Mathematics will not increase the students' math skills at a rate that would allow for them to attain grade level math skills.

The research question will be discussed in depth in Chapter 3.

Definition of Terms

Curriculum-based measurement: Curriculum-based measurement (CBM) has been used as an evaluative measure in education for more than two decades (Deno, 2003; Fuchs, 2004; Shinn, 1989). A CBM involves evaluating the progression of a student's acquisition of basic skills that occurred during instruction (Deno, Espin, & Fuchs, 2002; Fuchs & Fuchs, 1999; Shinn & Bamonto, 1998; Shinn, Shinn, Hamilton, & Clarke, 2002). CBM is a standardized procedure that can be conducted repeatedly over time and provides information that is relevant in making instructional decisions regarding student

achievement (Deno et al., 2002; Fuchs & Deno, 1991; Fuchs & Fuchs, 1999; Fuchs, Fuchs, Hamlett, Walz, & Germann, 1993; Fuchs, Fuchs, Hosp, & Jenkins, 2001; Shinn et al., 2002). This assessment method is preferred in that it mirrors the skills that students are receiving during interventions and class instruction (Deno et al., 2002; Shepard, 2000). A CBM can be used in several academic areas including reading, math, and writing; they have been shown to be related to overall student achievement (Deno, 1985; Deno et al., 2002; Good & Jefferson, 1998; Shinn, 1989).

Intelligence: British psychologist Charles Spearman (1863–1945) described general intelligence, or the *g factor*. Spearman concluded after he examined a number of different mental aptitude tests that scores on these tests were remarkably similar. People in general who performed well on one cognitive test tended to perform well on other tests, in turn those who scored badly on one test tended to score badly on other. He concluded that intelligence or cognitive ability could be measured and numerically expressed (Spearman, 1904).

Learning disability: Samuel Kirk first used the term *learning disability* in his book in 1962 and suggested that term be used as part of the name of an organization that parents were starting as a support. In 1965, Barbara Bateman, a student of Samuel Kirk's described students with learning disabilities as having: "educationally significant discrepancy between their estimated potential and actual level of performance" (as cited in Hallahan & Mock, 2003, p. 18). Therefore, this definition was the beginning of the achievement-ability discrepancy in reference to students with LD. A new definition is beginning to emerge. The problem-solving model of the LD definition focuses on the

child and how he or she responds to instruction, through the implementation of a three step model, that includes the following steps: Step 1, students are universally screened; Step 2, Tier 1 implementation of class wide instruction while monitoring students' responsiveness to instruction; and Step 3, implementation of small group supplementary instruction while monitoring responsiveness to small-group instruction (Fuchs, Fuchs, & Compton, 2004; Fletcher, Morris, & Lyons, 2003, p. 32).

Math fluency: Fluency is conceptualized as responding with accuracy and fluency. In turn as the student learns a new skill, he/she will become increasingly fluent in that skill until it becomes automatic" (Axtell, McCallum, Bell, & Poncy 2006, p. 527).

Progress monitoring: assessments are defined measurements academic performance. That are administered more frequently than annually but less than daily-usually three to four times per year, but as often as monthly or weekly in interventions situations. This is to ensure the measurement of individual students progress. Progress monitoring measures the growth during the year and longitudinally over two or more years (Renaissance Learning., 2009).

Number sense: is recognizing the value that numbers carry. Starting with counting techniques and moving sophisticated understandings of the size of numbers, number relationships, patterns, operations and place value (National Council of Teachers of Mathematics [NCTM], 2000, p.79)

Response to Intervention (RtI): Brown-Chidsey and Steege (2005) stated that "RtI is a data-driven method for identifying, defining, and resolving students' academic and/or behavior difficulties" (p. 3). The implementation of RtI into the school system, is based

on the use a three-tiered model. In this model there are three Tiers of interventions designed and implemented in the local school setting. For the purposes of this study the Tiers are as follows; Tier 1 includes all students and their response to the general math curriculum used in the regular classroom. Tier 2 includes fewer students that have been identified as moderate to severe risk for academic failure in math fluency as well as core math concepts. Tier 2 includes interventions that will target specific needs through a variety of curriculum changes as well as small group instruction. The final Tier, Tier 3, includes an even smaller group of students that did not respond to Tier 2 interventions and will include a variety of interventions that will include, one on one interventions as well as continued exposure to the general curriculum and small group instruction. All three tiers include continual monitoring of the students using CBMs that will indicate progress or lack of progress.

Universal screening: Screening that is conducted that will lead to the identification of students that are struggling with a given subject. Universal screening testing is a brief measurement that is conducted at grade level. (National Center on Response to Intervention, 2012).

Delimitations, Limitations, and Assumptions

Past research had primarily studied reading interventions in identifying students with reading disabilities. I examined a Tier 2 intervention for mathematics to determine if students would benefit from the use of this intervention as well as implementation of research-based curriculum and interventions that would help the students become successful with mathematics in an elementary setting.

The study was delimited to a small urban school setting in the western United States. The population of the school is not varied in terms of ethnic background and or socioeconomic standing.

The purpose of this study was to determine if the intervention, SuccessMakers for Mathematics, enabled the students that had been identified as at risk for academic failure in mathematics to gain the needed mathematics skills to obtain grade level performance in the area of mathematics. The school houses kindergarten through ninth grade with approximately 904 students. The class size is approximately 22 students in each class per grade.

Summary

As the education system across the United States continues to struggle with the identification of students with specific LD, many children who struggle academically continue to go unnoticed within the education system. The data gathered through this study contribute to the literature to assist the educators in implementing effective RtI math interventions that will allow students to receive an education that meets their individual learning needs. The research also adds to the field of mathematic interventions. The education system in the United States must continuously undergo transformations so that educators may offer students the knowledge they need to become productive members of society as well as keep up with the increased demands of a global world. One way to accomplish this ever-evolving goal is to continue research on the cutting edge issues in education promoting social change that will allow the educational system to

move forward and continue to make advancements in the ever-changing world of education.

Chapter 2: Review of Literature

Introduction

NCLB (2004) required schools to identify students who are falling behind academically and deemed at risk. NCLB also encourages schools to provide scientifically-proven, peer-reviewed intervention programs that address the needs of all students who are not making adequate yearly progress (AYP). As a result, schools across the country struggle in choosing an approach that would meet the requirement set forth by NCLB to aid in the prevention of struggling students. School districts are also struggling to implement strategies, programs, and procedures that meet the requirements of AYP. Through the implementation of an RtI model, educators are slowly beginning to understand the importance of early intervention for struggling students and allow for new ways of conceptualizing learning that would support the student (Klinger & Edwards, 2006).

The National Research Center on Learning Disabilities (2006) defined RtI as an intervention process for systematically monitoring student progress through CBM, then making decisions about the student's progress and need for instructional modifications. The RtI model is designed to differentiate instruction to meet the needs of each student, allowing for interventions in the earliest of stages of academic struggles (Bradley, Danielson, & Doolittle, 2007). With the Reauthorization of IDEA in 2004, RtI was offered as an alternative approach that could assist in the determination of special

education services, but at the same time it would allow for the prevention of academic difficulties in struggling students (Fuchs et al., 2010). RtI models have been supported throughout research and have indicated that intensive early intervention for struggling students will increase the chances of struggling students to remain in a general education setting and may avoid later placement into special education (Fuchs et al., 2010).

I explored a Tier 2 intervention for mathematics in an elementary school setting using SuccessMakers, a computer aided program for students struggling and deemed at risk for mathematics failure. The literature review examines RtI as a model. It also examines data-driven decision making with regards to intervention implementation for students struggling to make adequate academic gains in mathematics.

I used the following research databases to obtain current scholarly sources: The Educational Resources Information Center (ERIC) and PSYC INFO. Some of the search terms used were *mathematics, math disability, early childhood mathematics, math intervention, curriculum-based measure, and response to intervention (RtI), elementary mathematics, and math education*. I also used several books written by professional educators and researchers. These books provided a foundation for information basic to the study. These books also made references to studies that were valid and pertinent to this topic. If some of the journal articles were not current, the articles gave author names and ideas for further investigation. Several documents from the U.S. Department of Education and Office of Special Education, available on the government website or in book form, gave current information regarding laws and policies of the topic being researched.

Review of Literature

Response to Intervention

Over the past 25 years there has been an increase in the rate of evaluation and subsequent placement of students with LD in special education programs across the United States (U.S. Department of Education, Office of Special Education Programs, 2013). In 1967, the year after IDEA was enacted, the number of children who were identified as receiving special education was 3.7 million, which accounted for 8% of the student population. That number had grown to 6.7 million or 14% of the population by 2007 as a result of the IQ -achievement discrepancy model (Aud et al., 2010). As a result of the increasingly high numbers of students identified as leaning disabled, there was an increase in the criticism of the effectiveness of instruction in both special and general education that targets struggling students. This has led to an outcry to identify effective instructional interventions that will support students who struggle in the general classroom setting.

As a result of that outcry, IDEA was reauthorized in July of 2004 and changes of this act potentially affected how students are identified as having a SLD. The changes in IDEA allowed for individual states to consider alternatives to the ability-achievement discrepancy model when determining if a student is eligible for special education services and the criteria are as follows:

1. Must not require the use of a severe discrepancy between intellectual ability and achievement for determining whether a child has a specific learning disability.

2. Must permit the use of a process based on the child's response to scientific research-based intervention.
3. May permit the use of alternative research-based procedures for determining whether a child has a specific learning disability. (USDOE, OSE, 2006, p. 2)

Because IDEA permits the use of an alternative means to identify students with LD, many districts began to use an RtI model to identify students with an SLD. The RtI model emphasizes early intervention, as well as prevention, by allowing a team of educators to intervene on behalf of the student prior to referring for special education services. The reauthorized IDEA includes specific language on the implementation of RtI. IDEA (2004) defined the implementation of RtI as a process that addresses the student's response to scientific research-based intervention programs as part of the evaluation procedures.

The definitions and implementation of RtI models stress the importance of regular progress monitoring, providing extra help to students who fail to make adequate progress in areas of math, reading, or any other academic area and tiered programs of intervention. While it is left up to each school district to determine how to implement RtI, the most basic premise of informed instructional decisions that lead to improved learning outcomes for each student is the underlying theory. The following three entities, The Council for Exceptional Children, National Research Center on Learning Disabilities, and National Association of State Directors of Special Education, set forth guidelines and recommendations on the implementation of RtI in a school setting.

The Council for Exceptional Children (2007) defined and made specific recommendations on how to implement an RtI model. The recommendations includes the use of a multitiered problem solving model of interventions. The most commonly used three-tier approach puts emphasis on the use of a universal core program for all students. When students fail to respond as expected to the instruction provided, then a second tier of instruction is needed that is more intensive but carried out in the general education setting. The third tier of instruction is specifically designed instruction that may be provided by special educators or related service personnel and aimed at alleviating the skill deficits in struggling students (Council for Exceptional Children, 2007, pp. 1–2).

While the National Research Center on Learning Disabilities (NRCLD) provides the following definition and "guidelines for implementing an RtI model: RtI is an assessment and intervention process for systematically monitoring student progress and making decisions about the need for instructional modifications or increasingly intensified services using progress monitoring data.

The National Association of State Directors of Special Education (NASDSE) provided the following definition and guidelines for the implementation of RtI:
RtI is the practice of providing high-quality instruction and interventions matched to student need, monitoring progress frequently to make decisions about changes in instruction or goals applying child response" date to important education decisions (2004, p. 3).

RtI is a proactive approach that monitors the progress of all students and allows for early detection of students that may be at risk for academic failure and allows for the

at risk student to receive additional support. This allows for early development, implementation, and evaluation of interventions that are used in the classroom or small group setting to better target the student's academic or behavioral struggles. It also allows for educators to find solutions to problems and provide targeted instruction (Fuchs & Fuchs, 2007)

RtI has three tiers that are based upon the cascade of services developed by Deno (1970). The three tiers were established and used to provide special education services to students in a mainstream setting (Deno, 1970, p. 235). Deno's theory could possibly allow for RtI teams to aid in the prevention of students from falling further behind academically, as well as provide a systematic and structured process that allows for development of effective classroom interventions. This model not only incorporates best practice to identify problems, but allows for educators to define the extent of the problem, explore options for interventions, implement interventions, and examine the effectiveness of the intervention (Flugum & Reschly, 1994). This model is a comprehensive process that involves a team of educators that will focus on using research based interventions to help those students who struggle to make academic gains.

The RtI model begins with research-based instruction in the general education classroom setting and universal screening methods administered to all students 3 to 4 times a year (Gersten et al., 2009). The results are then used to identify students who are at risk for academic failure or learning difficulties. These measures are brief and simple to administer and score, and have strong predictive validity (Gersten & Newman-Gonchar, 2011). It is only after the screening methods are administered that the data are

then analyzed and then students who are deemed at risk for math difficulties are then placed in a Tier 2 intervention that is aimed to ameliorate the students' deficits.

The RtI model of tiers allows for instructional supports, interventions, and assessments to become more intensive as students' needs increase (Berkeley, Bender, Peaster, & Saunders, 2009). The instruction in an RtI model includes approaches that have a solid research base and expose students to a balance of student-centered and teacher-directed approaches. Within this model the careful alignment of Tiers 1 and 2 is vital. According to Fuchs and Fuchs (2007), this allows for the student to move through the tiers with ease as well as making the interventions that much more successful. As a result of the fluid movement throughout the tiered model, students who make adequate academic gains as a result of the Tier 2 intervention will then be placed back in Tier 1. This is accomplished after a CBM indicates that the intervention being implemented has been successful and the student has made the gains needed to fill the gap in his or her academic skill.

I used the following model of RtI in the research study. The first tier includes the entire student body in the general education setting. In this setting, the intervention includes evidence-based core instruction for all students. Tier 1 is the stage in which teachers use universal instructional strategies and interventions. Teachers use research-based instruction and assessments from the beginning with every student: "There should be a scientifically sound core curriculum and intentional instructional practice" (Martinez et al., 2006, p. 3). Universal screening assessments in math and reading are administered three times during the school year to identify students who meet their grade-level

standards by using the core curriculum. In Tier 1, approximately 80% of all students should meet core curriculum standards. An estimated 20% of the students will not reach the benchmarks and standards and will need additional intensified instruction that provided by Tier 2 of the RtI process (Reutebuch, 2008).

The second tier of the RtI focuses on more skill directed interventions and instruction. This tier provides academic support that supplements the core curriculum and meets the identified academic deficits of the student and is documented by progress monitoring. The educators use the results of progress monitoring to adjust instructional practices and the interventions implemented in Tier 2 (Reutebuch, 2008). The second tier includes small group instruction designed to target students at risk by providing interventions aimed at skill deficits. The students are placed in second tier interventions using universal screening assessments (Brown-Chidsey & Steege, 2005). A team of interventionists provide the students with supervision for 30 minutes 4 times a week, and the students use the Tier 2 intervention of SuccessMakers Math. This instruction is supplemental instruction that includes ongoing progress monitoring for identified struggling students. These small groups are fluid groups allowing for students to move in and out of the groups based on informed instructional decision making as a result of progress monitoring. Research indicates that approximately 15% of the students who have academic struggles in Tier 2 will have their academic difficulties alleviated (Bender & Shores, 2007).

Educators monitor progress through the use of CBMs, which were developed in the 1970s through the work of Deno and colleagues (Shinn & Bamonto, 1998). CBMs

became popular in the mid-1980s and were used as a direct assessment of students' academic skills (Shinn & Bamonto,1998). They were used to determine the needs or skill deficits of the students, which eventually led to the use of CBMs as an intervention tool to accurately determine the need for continued interventions (Gresham & Witt, 1997). The use of a CBM is more appropriate than standardized testing for monitoring progress over time and provides teacher with individualized student data on academic progress (Shapiro, 2000). CBMs allow teachers to provide the student progress and can allow for academic and instructional decision making beyond the initial assessment (Eckert, Shapiro, & Lutz 1995). In a meta-analysis conducted on teaching mathematics to low achieving students, Baker, Gersten, and Lee (2002) identified that giving specific performance feedback to the students enhanced the overall achievement of the students.

CBMs can also help to identify more clearly the specific academic issues that need interventions, compared to standardized measures that may not be able to address the student's specific academic deficit (Shapiro, 2000). CBMs continue to play a vital role in the formative evaluation of the student's performance during academic instruction, in contrast to the summative evaluation that occurs after the academic instruction has occurred (Thurber, Shinn, & Smolkowski, 2002). CBMs also follow the guidelines set forth by the NMAP (2008) for "instructional practice should be informed by high-quality research" (pp. xiii–xiv).

The third tier placement is determined by lack of response to Tier 2 interventions and can include but are not limited to the following; additional small group instruction, adapted instructional content, different materials, and possible special education

placement (Bryant et al,. 2008). Tier 3 provides more intensive instruction and interventions aimed at the academic deficit. As a result of the intensity of interventions in Tier 3, some of the intervention time may replace part of the core curriculum instruction for these students.

Math Interventions

The current findings from several research studies indicate that approximately 5–10% of school age children have some form of a mathematics disability (Bryant, 2005; Fuchs et al., 2005; Fuchs, Fuchs, & Hollenbeck, 2007; Fuchs, Fuchs, & Prentice, 2004;). Not only do students that have been identified as having a disability in math struggle, but students in the general education realm also experience difficulties that warrant interventions. In 2007, the Nation's Report Card in Mathematics indicated that fourth grade students math skills were as follows: 19% below basic level, 43% basic level, with only 33% of the students testing at proficient level and 5% at an advanced level. Eighth grade students' math skills were: 30% below basic level, 39% at basic level, 29% at proficient level, and 7% at advanced level (Lee, Grigg, & Dion, 2007). With less than half of the students assessed performing either at or below basic level, it is essential to develop a different approach to aide students that struggle in mathematics.

Another study looked at international comparison of mathematics literacy scores of 15-year-old students in 2003. The United States scored lower than 27 of the 41 countries that participated in the study (National Center for Education Statistics, 2007). As a result of these findings, the NMAP (2008) indicated, "the delivery system in mathematics education— the system that translates mathematical knowledge into value

and ability for the next generation— is broken and must be fixed" (p. 11). The research also indicates three keys areas that pertain to the early identification and intervention on behalf of students affected by math disabilities: “(a). the nature of mathematics difficulties; (b) number sense as important for young children mathematical development and; (c) instructional implications related to preliminary findings about the predictors and measure of mathematical proficiency” (Gersten & Chard, 1999).

Recently researchers have come to understand that much like with a reading disability, those students who suffer from math disabilities would benefit from the same type of early intervention and identification in order to develop a level of math proficiency that is necessary for success in an evolving global world (Chard et al., 2002). However, until recently, the study of math interventions in relation to the RtI model has been somewhat limited. The main focus of the previous studies has been on addressing basic math facts, or simple computation, using interventions that include drill and practice for a number of sessions. Fuchs (2008) indicated there is a need for RtI studies that use math interventions to identify math disabilities to incorporate the following;

> (a) validated treatment protocols, (b) other major components of the mathematics curriculum, (c) a sustained approach to intervention (d) random assignment to substantiate the overall efficacy of the intervention to which responsiveness is gauged, (e) more classrooms to represent the carrying quality of classroom math instruction, (f) analyses that systematically explore the tenability of varying methods for operationalizing responsiveness and thereby define disability, and (g) longitudinal follow up. (p. 351).

Historically, most research about assessment, intervention, and progress monitoring has focused on literacy (Thurber et al., 2002; Wallace, Espin, McMaster, Deno, & Foegen, 2007), with only a sparse number of researchers examining specific math programs or interventions (Agodini et al., 2009; Chard et al., 2008; Newman-Gonchar, Clarke, & Gersten, 2009; Slavin & Lake, 2008).As a result of the limited number of research studies conducted in mathematics, a meta-analysis on math interventions concluded that explicit and systematic instruction and scaffolding of instruction that allowed for visual representation of the math skill are effective methods of interventions for students struggling with mathematics (Barker, Gersten, & Lee, 2002).

Scheuermann, Deshler, and Schumaker (2009) studied an explicit instruction model for solving word problems using a concrete-representational-abstract (C-R-A) instructional sequence. The purpose of their study was to determine the effectiveness of the C-R-A instructional intervention in both the general and special education setting with students struggling in mathematics. Twenty students between the ages of 11 and 14 participated in the study. In this study Scheruermann et al. used a teaching model that involves research-based mathematics practices from the general education as well as the special education setting. The intervention was implemented daily for 55 minutes during the mathematics lesson. The researcher collected data throughout the study and included pretest and posttest assessments along with progress monitoring probes. The results indicated that all students had significant growth after the interventions, and the Scheuermann et al. determined that students with math learning disabilities can increase their ability to progress in mathematics through the use of Tier 2 interventions.

Jitendra et al. (1998) examined the effects of an intervention model using a schema-based instructional strategy to teach math facts in addition and subtraction using word problems to students with mild LD and students who were deemed at risk for math failure. They collected data in four public schools and included 34 students from second through fifth grades. Jitendra et al. then used pretest and posttest measures to determine the students' growth in their ability to solve word problems using addition and subtraction facts. The results indicated that students using schema-based instructional strategies as an intervention that was above and beyond core instruction outperformed the students who did not receive the instruction. These results suggest that with the use of an intervention, students struggling with mathematics concepts perform similarly to students without disabilities (Jitendra et al., 1998).

In a later study, Jitendra, Hoff, and Beck (1999) sought to replicate these findings about the effects of schema-based instructional strategies, as well as examine the generalization from one-step addition and subtraction word problems to two-step word problems. This study took place with four middle school children ranging in age from 12 to 14 years old that had been identified as having an LD. A comparison group of 21 typically achieving students was used for testing only. The 4 students received the schema-based instruction during their 45 minute period of resource pull out. The results of the study indicated that students exposed to schema-based instructional strategies were better able than peers who did not receive the Tier 2 level of intervention to solve one- and two-step word problems with addition and subtraction.

In a case study at Riverbend Elementary School, that was utilizing an RtI model, Powell and Seethaler (2008) studied 210 students in kindergarten through fourth grade. A first and third grade teacher met every other week to discuss student progress, review data, and examine instructional needs. The researcher used a CBM math concept applications test to assess all students. Students with a mean score of 10 points or less on the test received interventions over a 6 to 10 week period (Powell & Seethaler, 2008). The teachers used Hot Math, a word problem skills program that was implemented for 45–60 minutes two times a week through the use of a math tutor. The students in Tier 2 interventions responded positively to the increase in instruction as well as the implementation of a math tutor twice a week. This study also indicated that a tiered system met the needs of students struggling in math concepts and allowed for favorable interventions.

In an additional study, Torgeson (2003) reported that the RtI method held significant promise for students in upper elementary grades and examined the RtI model in third grade students to help improve reading skills. The purpose of the study was to determine if using interventions in the upper grades would continue to help students who are struggling and enable them to make adequate gains that are commensurate with their peers. The study showed that the students that received interventions that included high-quality instruction and data-driven progress monitoring were able to make significant progress in their reading skills (Torgeson, 2003).

In another case study, Bryant, Bryant, Gerstein, Scammacca, and Chavez (2008) studied a total of 26 first grade students and 25 second grade students in a Tier 2

intervention for mathematics. The intervention included a 15 minute session that was a booster lesson focusing on the core curriculum taught in class. These sessions were held 2 to 4 days a week for 18 weeks. During the sessions, the students received explicit instruction on number concepts, base 10 and place value, and addition and subtraction combinations. The findings using CBMs for the first-grade students in tier two did not show a significant effect; however, the second-grade students showed a significant main effect, indicating that the intervention showed promise for students. The researchers noted that the first-grade students would continue in the intervention groups throughout the year and noted that the length of time for the first-grade students may need to be longer (Bryant et al., 2008).

In a study that examined first grade students in 41 classrooms at 10 different schools, Fuchs, Fuchs, and Hollenbeck (2007) identified students at risk for math difficulties based on low initial performance on a C. They then randomly assigned students to tutoring and control groups. The control group received regular classroom instruction using the district's basal program. The students identified for participation in the tutoring group received tutoring in a small group that consisted of approximately two to three students, three times a week for 40 minutes. This group included 30 minutes of instruction and then 10 minutes of computer-guided practice on the math concept, and took place over a 20 week period. The findings from the study support the use of Tier 2 interventions for students exhibiting math difficulties (Fuchs et al., 2007). The improvement of the students in the tutoring group exceeded the improvement made by students in the control group. These results support the research that indicates that

interventions can be effective at promoting stronger math outcomes with struggling students. It also suggests that RtI interventions in as early as first grade for mathematics can reduce the number of students that struggle with math concepts.

Conclusion

Many concerns are present throughout the literature that indicate the need for additional research in the area of mathematics and RtI. One concern in the field was the lack of research available in the literature regarding mathematics. There is a significant discrepancy in the amount of research that has been invested in reading and literacy as compared to mathematics. The limited research and curriculum development in mathematics is very evident when it is compared to the amount of research and curriculum development in the area of reading (Gersten, Jordan, & Flojo, 2005; Horowitz, 2007). Horowitz (2007) attributed this lack of research and lack of mathematic interventions on the lack of understanding on how to teach specific mathematic skills to students that are not making adequate gains. There is a need for more research to implement effective math interventions programs that can be used throughout the education field to help to determine lagging math skills in students as early as kindergarten.

Another concern is the conflicting ideas of how to best serve children who are struggling to make gains in mathematics. As a result of the research as well as the introduction and acceptance of the RtI model into school settings across the country, the method with which educators identify and intervene with students who are struggling to

make adequate academic progress in the area of mathematics could possibly be changed to better address the specific needs of the student.

Finally, research in the area of mathematics and the effects of early mathematics intervention has shown that a strong foundation of basic math facts as well as number sense will lead to continued success in mathematics. The need for increased research in implementing RtI and its utility for improving number sense as well as mastery of basic math concepts is very limited. Similarly, the need to conduct research on interventions that will aid struggling students in the area of mathematics and using RtI is minimal; as a result, the current study determined if the CBM Success Makers-CBM (Pearson) as a Tier 2 intervention helped students who are deemed at risk for academic failure in mathematics.

Chapter 3: Research Method

Introduction

RtI is a concept that educators have used for years in the special education field to address the needs of each individual student in a three tier model (Deno, 1970). Since the passing of IDEA and NCLB, it has become a model that has enabled educators to meet the needs of struggling students, as well as help with the identification of students with a variety of different LD. In the past, schools have used the IQ-discrepancy model to identify students with LD, which resulted in a full psychoeducational evaluation in an attempt to determine if a discrepancy between the student's IQ and achievement existed. One of the major criticisms of this method is that some children would complete several years of schooling before a sufficiently large enough discrepancy was found to qualify them for services under IDEA. These students would continue to fall further behind. RtI seeks to prevent students from falling further behind by providing early screening and intervention for lagging skills in all areas of academics. Research on mathematics interventions in an RtI framework is a fairly new field (Gersten et al., 2007). This study examined Success Makers for Math, a computerized program used at the Tier 2 level for students struggling in mathematics.

I chose a single-subject research design for this study. By examining SuccessMakers as an appropriate Tier 2 intervention for mathematics, I was able to measure the success of this particular intervention for students struggling in mathematics. This method of identification is key in changing how educators identify and teach students who struggle in all aspects of education. It is critical that educators embrace this

change in a model of intervention as a tool that will enable them to provide interventions to all students. This can only be accomplished by differentiating instruction to meet the needs of the continuously changing landscape of diverse students.

This chapter will discuss the single-subject design, research setting, participants, selection criteria, data collection, data preparation, study procedures, and analysis procedures.

Research Design and Approach

Students who struggle with academics often require individualistic approaches in teaching in order for their unique needs to be met. Single-subject research allows the researcher to examine the progress of the individual students and allows for the researcher to determine if the chosen method of intervention is a reliable intervention that allowed the student to make significant gains in the measured academic area (Barger-Anderson, Domaracki, Kearney-Vakulick, & Kubina 2004). This research design grew out of the behaviorist school of thought in the 1950s that examined the casual relationships that psychologists were examining in treatment of individuals through the manipulation of variables (Harvey, May, & Kennedy, 2004; Horner, Carr, Gail, Samuel, & Wolery, 2005). Researchers use single-subject designs in mathematics research to measure the effectiveness of the instructional strategy, while paying specific attention to individual change (Swanson & Sachse-Lee, 2000).

Single-subject experimental design methods are important in the assessment and intervention phases of RtI. The methods support the problem-solving model of addressing the needs of struggling students at school (Berg, Wacker, & Steege, 1995; Brown-

Chidsey et al., 2008; Polaha & Allen, 1999; Steege, Brown-Chidsey, & Mace, 2002). A single-subject design is based on a hypothesis testing approach that allows for specific designs to be used to test the specific hypothesis. This design also allows for comparison of the effectiveness of interventions, therefore allowing the researcher to select the most effective intervention that will directly address the needs of the student (Swanson & Sachse-Lee, 2000).

Single-subject designs have been previously used to test different intervention components to identify the effectiveness of the intervention. In those studied, the single-subject design measured the impact of a Tier 2 mathematics intervention on mathematic skills with fifth grade students in an elementary setting who were identified as at risk for academic failure in mathematics through a RtI model in an urban community in Weber County in northern Utah.

Method

The purpose of the current study was to determine if SuccesMakers, a Tier 2 math intervention, increases math fact fluency and knowledge of applied math skills for students with low math performance and deemed at risk for math failure in an elementary school setting.

I used a single subject design to evaluate the effects of the intervention on math performance of students who met research criteria for low math performance and were deemed at risk for math failure.

Participants and Setting

I selected participants from general education classes from fifth grade classrooms in a charter school setting. The RtI model has been in use in the school during the past 3 years and is the current model. I chose the fifth grade population as a result of the need for students at this level to master core math concepts in order to move forward into more advanced math concepts.

The school contains 904 students, grades kindergarten through ninth grade. Based on the most recent demographic and educational data from the school, 243 of the students received federal free or reduced lunch; 119 of the students from ages 5 to 15 years are in special education; 87 of the students are Hispanic/Latino; 11 students are American Indian; 10 students are Asian; 12 students are African American/Black; 9 students are Pacific Islanders; and 881 students are White.

In this section, I outline the participant selection through the use of an RtI model in determining at risk students: (a) schoolwide CBM screening, (b) initial selection of general education students, (c) consent procedure, and (d) placement into intervention group.

Schoolwide CBM Screening

During the year of the study and previous years, academic screenings were administered to all students in the school. The CBMs are administered 4 times a year in the areas of reading and mathematics. The CBM screening for mathematics consists of Star Math, administered by a team of teachers who are designated as interventionists.

The initial selection of the students in the general education classes was determined by the intervention team along with the fifth grade team of teachers. Students selected met a math level that was within the frustration level according to the CBM assessment, falling within the 4.0 to 4.5 grade level according to the Star Math test.

I obtained the permission of the principal in the charter school setting to conduct this study. Once I obtained Institutional Review Board (IRB) approval (see Appendix C), I met with the intervention team and fifth grade team to determine which students would participate throughout the study. The parents of the students selected for the study were notified by the school with a letter indicating that their student was at risk for academic failure in the area of mathematics and as a result would benefit from intervention instruction in the area of mathematics. The parents had the right to refuse intervention services, and at that time the students were then not pulled to participate in the Tier 2 intervention of SuccessMakers.

Measures

Within the RtI framework multiple measures ensure success for all students through a tiered system of support and interventions that is monitored. I used the progress monitoring tool built into the SuccessMakers program. I used STAR math for pretest and posttest assessment progress monitoring.

STAR math is a reliable and valid computer-adapted assessment used to determine math achievement, which was the dependent variable in this study. It provides math scores that are nationally norm-referenced and criterion-referenced of the student's skill levels in mathematics. The program utilizes state standards, various curriculum

materials, test frameworks, content area research, and best practices of math instruction (Renaissance Learning, 2009).

The STAR math test has the ability to assess 550 math skills in four standard domains: Numbers and Operations; Algebra; Geometry and Measurements; and Data Analysis; Statistics and Probability. Within each domain the skills are organized into sets of closely related skills and are modeled after the Common Core State Standards. (Renaissance Learning, 2011).

The STAR math tests give scores in the following areas: scaled scores (SS) is based on the difficulty of questions and the number of correct responses. This score can range from 0–1400 and can be used in comparing a student's performance over time and across grades. The percentile rank (PR) is a norm-referenced score that determines the amount of statistical variability in a student's performance. Normal curve equivalent (NCE) a norm-referenced score that is similar to the PR but based on equal interval scales. This score is useful in making comparisons between different achievement tests. The grade equivalent (GE) is a norm-referenced score that ranges from 0.0–12.9+ and is used to determine a student's test performance when compared to peers in the same grade nationally. Grade placement (GP) is a numeric score of the student's grade level of performance when taking the STAR math test. Math instructional level (MIL) is the final test score, and it determines the student's current level of math instruction in order for the student to not be a frustration level but at a level that would promote academic learning (Renaissance Learning, 2011).

The reliability of Star Math is the extent to which the benchmark tests are consistent from one administration to another. Renaissance Learning reports that the internal research conducted on Star Math test scores have a very high level of not only internal consistency reliability but also a high level of alternate-form reliability which suggests that it is consistent with other tests used to measure the same academic skill.

Split-half reliability and alternate forms reliability analyses of Star Math were collected during the norming phase of the test. The split-half reliability used a sample of 29,228 students and gave the following estimates of reliability: 0.94 overall and 0.78–0.88 by grade with a median of 0.85. The alternate from reliability estimates were based on 7,517 students who participated in the reliability study only. By grade the reliability ranged from 0.72 to 0.80 with the median values of 0.74 (see Table 1; Renaissance Learning, 2011).

The validity of Star Math as a measure of the degree to which the test professes to measure is strong. Star Math tests scores have evidence of a high correlation to overall math scores that are on many high-stakes standardized tests such as the California Achievement Test (CAT), Comprehensive Test of Basic Skills (CTBS), Iowa Tests of Basic Skills (ITBS), and the Metropolitan Achievement test (MAT), suggesting that the measure is valid (Renaissance Learning 2011). See Table 2, which represent the correlation coefficients between the Star Math test and the above referenced test.

SuccessMakers is an interactive, standards-based curriculum that is being used as a Tier 2 intervention program at the Charter School for students who struggle to make academic gains in the area of mathematics. This intervention helps students in the

development and maintenance of fundamental concepts and assists with the development of problem-solving skills taught in mathematics in Grades K through 8.

This program is based on principles and standards set forth by the NCTM and the state of Utah. It encompasses the following seven strands of instruction in the mathematics: (a) data analysis, (b) geometry, (c) measurement, (d) number sense and operations, (e) patterns, algebra, and functions, (f) probability and discrete mathematics, and (g) fluency for speed (SuccessMaker Math, 2010).

Upon initial placement each student is given a selected starting level based off previous math performance. The computer software then monitors each student's progress every 30 questions, SuccessMaker Math then judges the student's performance at the current level and adjusts accordingly to a level that is neither too difficult nor too easy (SuccessMaker Math, 2010). If the student is doing well, the program moves the student up a half a grade level in order to challenge the student; if the student is not performing well, then the student is allowed to stay at the same level until mastery is achieved.

Procedures and Consent

Permission to conduct the current study was obtained in writing from the principal of the Charter School (see Appendix A for permission forms). An Institutional Review Board (IRB) proposal was submitted to Walden University to seek permission to conduct the current study with elementary school age students. I began the study once I received approval from Walden University's IRB (see Appendix C) and permission was granted by the charter school (see Appendix D).

I worked with the school principal, who referred me to fifth grade teachers, to seek recruits for the current study. Letters explaining the purpose and nature of the study were sent to the fifth grade teachers requesting referral for students exhibit low math performance.

Parents of the referred students were contacted, received an explanation of the study, and were asked to provide written consent to proceed with the screening process that is incorporated in the school's RtI model for intervention services to be provided to students who are at risk for academic failure in mathematics (see Appendix A for a copy of the parent permission letter). The participants in this study and their legal guardians were provided with a detailed written description of the study including the purpose of the study, details regarding the math intervention program, potential benefits, and the minimal potential risks.

Legal guardians were provided with a letter of consent that they were required to sign if they chose to have their child participate in the study. The form contained contact information regarding where and when the researcher could be reached to field any questions the guardians or the participants may have had regarding the study. Legal guardians and their children's participation were voluntary, and they could have removed their children from the study at any time.

Legal guardians and participants were also informed that personal information was not used in this study; each student's information was coded to maintain confidentiality, and students' names were changed as well information was coded to maintain confidentiality. All student data were stored on the researcher's computer,

which required a password to access. Copies of the assent and consent forms are included in the appendices.

All procedures were implemented in 30 minute pull out sessions with an interventionist five days of the week. The classroom was the interventionist classroom in the elementary school setting. The room was quiet and had proper lighting. The room was occupied by no more than three interventionists and the students designated as receiving interventions. The following sections describe the procedures using in the study: (a) training of the interventionists, (b), skill deficit assessment, (c) pretreatment assessment, (d) pretreatment scores, (e) intervention implementation, and (f) treatment and procedural integrity.

Training of the Interventionist

Pearson Inc. and Renaissance Learning were able to train the team of interventionists prior to the start of the study as part of their in-service training provided by the charter school. This included free training facilitated by a curriculum specialist who was provided by Pearson and Renaissance Learning; all teachers and interventionists using these programs were required to attend the training. The training included understanding the SuccessMaker, Star Math programs, student login, learning environments, classroom management, reporting systems, and how to implement the testing and interventions. These sessions were completed in a group presentation, and then teachers and interventionists were moved to computers where they were given the opportunity to use the program as if they were students.

Pretreatment Assessment

The school conducted a pretreatment assessment in order to determine the current grade level of each student using the CBM Star Math. Students who fell within a frustrational level determined by scores that are one grade level below current grade level were grouped into smaller intervention groups. I obtained permission from parents for students to participate in the intervention group via letters sent home that informed the parents of the school's concerns and requested permission for intervention pull out.

Parents' consent was needed due to the fact that the students were pulled out from the general education setting. Participation was not mandatory, and if the student's parent refused, the student did not participate in the intervention.

Intervention Implementation

For each student, SuccessMakers mathematics was implemented for 20 sessions (5 sessions per week for 4 weeks). Intervention progress was examined through the use of computer assisted monitoring with Star Math. program. Each student was pulled in a small group for 30 minutes 5 times a week and during that small group the students are instructed to use SuccessMakers Math program. A team of interventionists supervised the students during their pull out sessions to ensure proper log on, as well as continued participation in the computer based program.

The team of interventionist were given explicit instruction on how to open and operate the computer software programs and were allowed to explore and practice using the program under the supervision of the training team. Interventions were given an instruction sheet with written information regarding how to use SuccessMakers Math.

This sheet was utilized as a reminder and checklist for each intervention session. The instructions were also given to the students participating in the study and were also on a worksheet. (see Appendix B)

On the initial day of the intervention the students were given Login information and assigned a specific computer with headphones. The students were then instructed to "get ready to log into your SuccessMaker Math accounts. Double click on the SuccessMaker Math icon. It is the Icon with the S and on it. Type your username and password, now everyone click on begin, keep working until we tell you to stop.

Students will work for 30 minutes, while the interventionist supervises, if the students have questions or complications they were addressed as they arise by the interventionist. Over the course of the four weeks of interventions the students received computer based math instruction utilizing SuccessMakers Math for 30 minutes 5 times week. Interventionists read the standardized instructions to the students daily, interventionists encouraged the students that were not working or being noncompliant through the use of precision commands to maintain on task behavior. Interventionist also praise the students when completing a lesson and for working hard.

Post Intervention

At the end of the intervention period, a post-test using STAR math was administered to each student to determine if growth of math skills took place through the use of the tier 2 intervention of SuccessMakers Math. The posttest assessment was administered by the team of interventionist in a small setting utilizing the same computers and instructions. The researcher used a paired samples *t* test to measure mean

differences between the pretest and the posttest STAR results of math achievement.

The paired samples *t*-test was used for the data analysis because the study consisted of a single sample of individuals which was tested more than once on the same dependent measure. The researcher ran a paired samples *t*-test on the mean difference score for students receiving SuccessMakers Math intervention using the pre and post test of STAR Math. Table 1 details the results for the difference scores between the mean of pre SuccessMakers Math Intervention and Post SuccessMakers Math Intervention. This analysis included the determination of the differences in pre-test and post-test Star Math assessments to determine overall math growth.

The researcher obtained the results of the pretest and posttest from the interventionist at the elementary school. The test results are required to be pulled three times a year by the charter school and given to the intervention team. The researcher used the identical data for the study as the charter school uses for accountability checks. Results were displayed in a table format which used only the means and standard deviation for the pretest and the posttest.

Summary

The purpose of this study was to measure the effects of SuccessMakers Math on math achievement. The researcher attempted to measure math achievement with the implementation of a tier II math intervention of SuccessMakers, Through the use of the STAR test; which has been tested for reliability and validity. The data was analyzed and displayed in Chapter 4 with a summary of the findings and suggestions for further research detailed in Chapter 5

Chapter 4 Research Results

This study examined pretest and posttest scores of fifth-grade students who participated in the academic intervention program in Northern, United States. The targeted group of students for this study included students who did not meet the required score of 5.0 grade level on the initial administration of the Star Math Test. The purpose of this study was to determine the impact of the academic intervention program on student achievement in mathematics. This chapter is organized in terms of the research question presented in Chapter 1. It reports the impact of the Star Math posttest scores for those fifth-grade students who participated in the intervention program that utilized specific RtI interventions in mathematics. The chapter includes a sample description, research question, hypotheses and results of the investigation.

Description of the Sample

The population from which the sample was drawn was determined by the 2013 initial Star Math test. All students in the Charter School were administered the Star Math test upon entering school in September of the 2013-2014 school year. For the 2013-2014 fall administration, all fifth graders took the initial Star Math Test. From that initial population, the researcher disaggregated the data into groups of students who met the standard (performing at grade level 5.0 or above) and did not meet (performing below grade level 5.0 ranging from 4.0 to 4.5 grade level). Of that population, 10 students did not meet the 5.0 grade level on the Star Math test. The purpose of this study was to determine if SuccessMakers Math intervention increased students 'math retest scores.

Several factors were involved when determining the sample for this study. Fifth grade marks the final year in which students remain in the elementary setting in which the basic skills of mathematics are reviewed prior to entering into advanced concepts taught in junior high. Without mastery of basic math concepts students will continue to struggle often leading to the inability for students to make progress towards more advanced math skills. The researcher selected only students whose scores fell within one grade level below current grade level of 4.0 to 4.5according to the Star Math test and had been referred to RtI tier two interventions.

Students 1, 2, 7, 8 , 9, and 10 were all female 11-year-old students that were in the fifth grade regular education class. Student 3 was a 11-year-old male, Student 6 was a 10-year-old female in the fifth grade regular education group. Student 4 was a 11-year-old male, Student 5 was a 10-year-old male in the fifth grade regular education group.

Presentation of Data

Research Question

The research question that guided this study was: "Will the implementation of a Tier 2 math intervention, SuccessMakers, (independent variable) allow for growth in individual math skills (dependant variable) with a student that has been identified as struggling with math skills in order to be on grade level or within a year of grade level math skills?"

To answer this question, the researcher examined fifth-grade students math performance as measured by the Start Math Test. The null hypothesis associated with the research question stated there was no statistical significance with the use of

SuccessMaker Mathematics on student's math skills at a rate that would allow for them to attain grade level math skills. The alternative hypothesis states that there will be a statistically significant difference in the students math performance after utilizing SuccessMaker Mathematics. The student's will increase their math skills at a rate that would allow for them to attain grade level math skills.

The framework for this study was based upon the RtI theory. RtI is a proactive approach that monitors the progress of all students and allows for early detection of students that may be at risk for academic failure and allows for the at risk student to receive additional support. This allows for early development, implementation, and evaluation of interventions that are used in the classroom or small group setting to better target the student's academic or behavioral struggles. It also allows for educators to find solutions to problems and provide targeted instruction (Fuchs & Fuchs, 2007). The supplementary activities and methods provided multiple layers of instruction in order to build on students' strengths rather than focus on deficits.

Statistical Analysis

Statistical analysis for this study consists of both, non- parametric analysis that included Paired T test using pre-test and post test data from Star Math, and visual analysis of graphs. Statistical analysis is essential to ensure objective and reliable interpretation of data. Traditionally, single case research design has utilized visual analysis but increasing documentation reveals the unreliable nature of visual analysis (Harbst, Ottenbacher, & Harris, 1991; Ottenbacher, 1990). Therefore, data analysis for this study integrates both statistical and visual analysis.

Microsoft Excel program was utilized to plot visual analysis, trend line, and r-squared. A marked benefit for the single case design is that the researcher can begin graphing the measures at the onset of the treatment. The visual analysis must reveal the following four criterion standards: 1) the mean of performance is greater than the baseline performance trend; 2) the baseline phase has no overlapping data points; 3) an achievement of 100% accuracy compared to baseline; and 4) all three components reached criterion. In addition, statistical analyses were conducted using the SPSS statistical analysis software on the pre-test and post-test scores of each students Star Math performance.

Most single case designs, allow for improvement to be measured visually by, (a) large changes measured at the intervention point (a increase in level), (b) changes in mean level between phases (baseline vs. intervention), and (c) changes in slope (rate of learning) or r-squared. This method possesses the advantage of considering multiple aspects of change at once. However, the disadvantage of visual analysis is that it possesses low inter-rater reliability (Kazdin, 1982) Along with visual analysis, the following statistical analyses are often conducted: changes from the first to last assessment, mean differences between interventions, and changes in slope and level (r-squared). All of these tests can be considered together to help determine change over time and between intervention. Two of these analyses can provide evidence of intervention success: 1) visual analysis and 2) statistical analysis of changes in slopes. These analyses provide evidence not only for change overtime but the fact that the intervention caused

the change.

The regression line procedure allowed the researcher to identify a line of best fit between the data points with the intervention in order to display trends in the data; the regression line will then facilitate determination of treatment effects if the line differs in intercept or slope relative to the baseline (Morgan & Morgan, 2009). Furthermore, observing the trend in baseline will enable the researcher to predict where other data points within the baseline may lie (Morgan & Morgan, 2009). It will also allow for the researcher to determine effect size.

Daily Progress Monitoring was completed through the use of SuccessMakers Math Intervention. The following figures present a graphical representation of each student‘s performance on the independent variable across the 4-week period of the study. The 3 phases of the study were a) pre-test, b) intervention, and c) post-test. The first score represents the student’s starting skill set as determined by the results of the SuccessMakers Progress Monitoring component. Each consecutive score represents the student’s progress throughout the study.

The students were described by teachers as having difficulty with mathematics and performing at one grade level below 5.0 according to the Star Math Test. The intervention team suggested that students complete 4 weeks of small group intervention on SuccessMakers Mathematics.

Individual Student Results

Students 1-10 participated in a total of twenty sessions that consisted of 30 minutes of intervention using SuccessMakers Mathematics. The students results will be

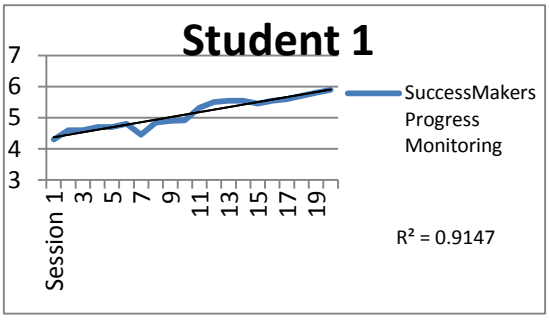
broken done by effect size and each groups result discussed in detail. The treatment for these students occurred in the afternoon, with no missing sessions. A graphical representation below depicts the visual analysis during the intervention phase of the study, included is a trend line that depicts the growth in progress monitoring of the Math skill for students 1-10 utilizing the SuccessMakers Progress monitoring.

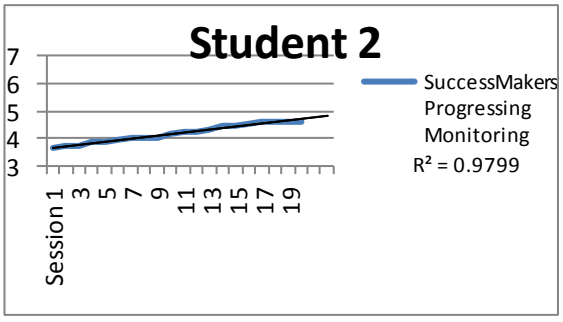
Outcome Date for Student's with Large Effect Size

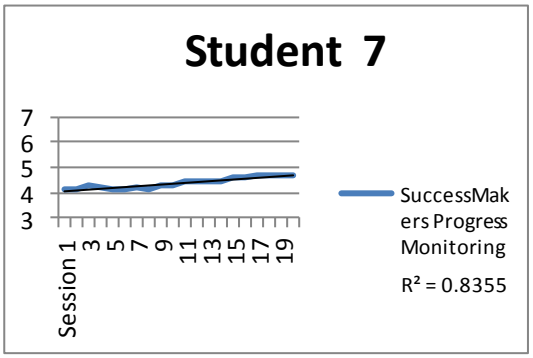
All students completed the 20 sessions of intervention in a small group setting as a RtI tier II intervention that was aimed at increasing the overall math scores to grade level of 5.0. The progress of each individual student with a large effect size is graphed in Figures 1-6 to show the visual analysis with the trend line that documents progress.

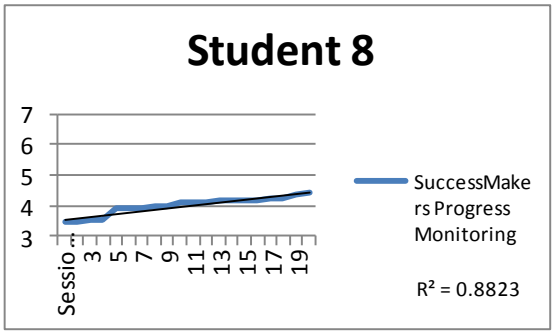
The students with a large effects size of 0.83 or greater were able to make significant gains in 20 sessions of intervention and were able to return to the regular education setting without further interventions.

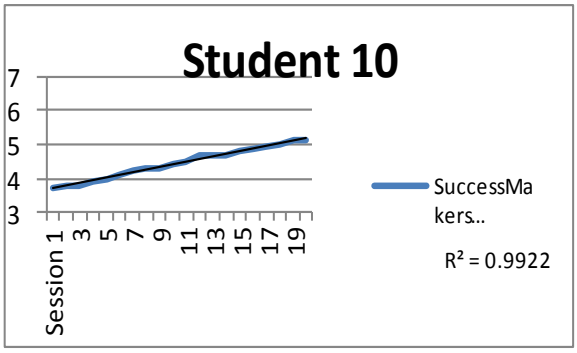
Figures (1-6).....











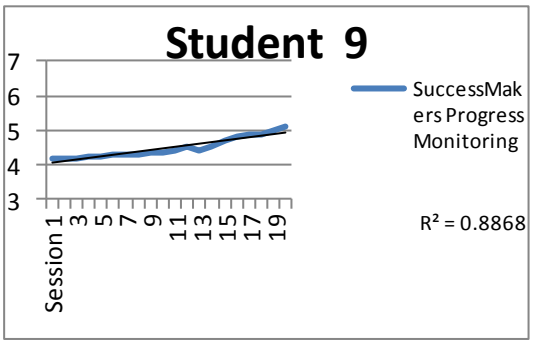


Table 1 is a summary of the beginning score, increase in mean score, and intervention effects size.

Table 1

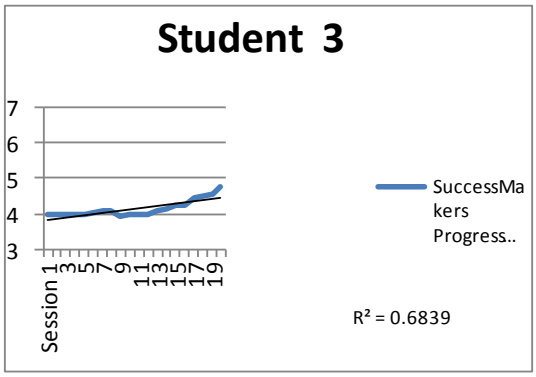
Individual Student Scores and R^2 Effect Size

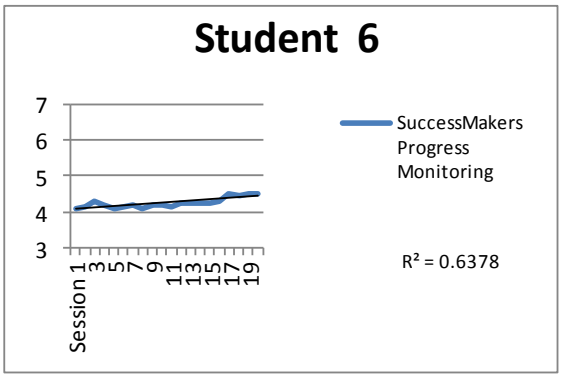
Variable	Beginning Score	Increase in Mean Score	R^2 Effect Size
Student 1	4.3	5.32	0.9084
Student 2	3.65	4.19	0.9799
Student 7	4.15	4.36	0.8355
Student 8	3.85	3.98	0.8823
Student 9	4.17	4.49	0.8868
Student 10	3.69	4.43	0.9922

Outcome Date for Student's with Moderate Effect Size

The progress of students 3 and 6 is graphed in (figures 7-8) to show the visual analysis with the trend line that documents progress.

figures 7-8





The students with a moderate effects size were able to make adequate gains in 20 sessions of intervention. The following (Table 2) is a summary of the beginning score, increase in mean score, and intervention effects size. Student 3 and 6 would continue to benefit from SuccessMakers Math Intervention in a small group setting to continue her progress towards the grade level goal of 5.0 or better.

Table 2

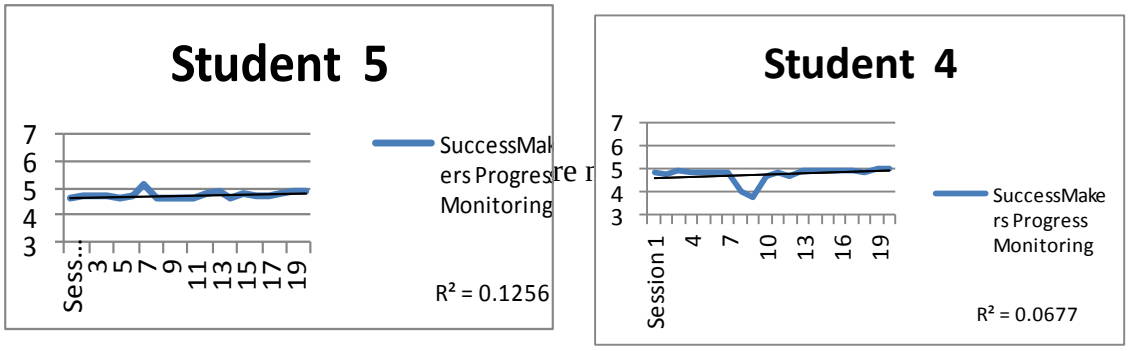
Individual Student Scores R^2 Effect Size:

Variable	Beginning Score	Increase in Mean Score	R^2 Effect Size
Student 3	3.95	4.15	0.6839
Student 6	4.1	4.25	0.6378

Outcome Date for Student's with No Effect Size

Students 4 and 5 completed the 20 sessions of intervention in a small group setting as a response to intervention tier II intervention that was aimed at increasing the overall math scores to grade level of 5.0. The progress of each individual student is graphed in (figures 9 and 10) to show the visual analysis with the trend line that documents progress.

Figures 9 and 10



(Table 3) is a summary of the beginning score, increase in mean score, and intervention effects size.

Table 3

Individual Student Scores R^2 Effect Size:

Variable	Beginning Score	Increase in Mean Score	R^2 Effect Size
Student 4	4.85	4.75	0.0677
Student 5	4.65	4.63	0.1256

Student 4 made little to no progress and would benefit from additional interventions that are aimed at specific skill deficit in order to determine if the student would respond to a different form of intervention.

Student 5 would continue to benefit from SuccessMakers Math Intervention in a small group setting to continue his progress towards the grade level goal of 5.0 or better. He had sporadic progress throughout the intervention, it should be noted that there were several sessions in which he had to check out of school early and that could be a variable in his progress towards achieving grade level performance.

Pre-Post-Test Analysis

The data in Table 4 indicates that the fifth-grade students who participated in RtI tier two intervention improved their math scores on the second Star Math Test administration. The paired t test shows that student scores prior to the intervention program were a mean of 4.18 and then increased to a mean of 5.35 after the intervention program. The change in Star Math scores for participants in the program was

significantly higher for math scores from the initial test administration to the retest administration ($t = 4.690$, $df = 9$, $p = .001$). This increase is statistically significant indicating that the academic tier two intervention program, with addition of SuccessMakers Math is an effective tier two intervention program that increased student Star Math Scores.

Table 4

Paired Sample t Test of Effect of Intervention on Star Math Score

Variable	Mean Test Score	Standard	Sig. Error
Pre-Intervention students (n=10)	4.18	.18135	.381
Post-Intervention Students (n=10)	5.35	.82630	

In addition, the researcher disaggregated the data by individual student score (Table 5). Of the 10 students who fell 1 grade level below on the initial assessment and participated in the protocol and retest, 5 students improved their scores by enough points to meet grade level with a score of 5.0 or above. Although 5of the 10 students did not attain the grade level score of 5.0, 5 of those 10 students did show an increase in their scores.

Table 5

Individual Student Scores: Pre- and Post-Intervention

Variable	Pre-Score	Post-Score
Student 1	4.3	6.7
Student 2	4.0	4.8
Student 3	4.4	4.6
Student 4	4.4	4.6
Student 5	4.0	4.5
Student 6	4.1	5.6
Student 7	4.2	5.6
Student 8	4.4	6.7
Student 9	4.0	4.9
Student 10	4.0	5.5

Although 5 students did not meet grade level on the Star Math retest after intervention, the data indicates that the intervention program, coupled with the RtI strategies for the students, did positively impact the Star Math scores of those students in the study. The increase in 10 of the students' scores is an indication that the intervention was a successful in allowing for students to become more proficient in mathematics and allowed for increase in overall math performance working towards attaining grade level scores.

Summary

Each of the participants' initial Star math scores were collected and analyzed using a paired t test. The researcher compared the performance levels and raw scores of the initial assessment scores to the retest scores. Based on the statistical analysis, the researcher found that the fifth-grade students participating in the tier two intervention program had significantly higher math scores from the initial administration of Star Math test to the Star Math retest administration. In fact, although not every student who attended intervention met the grade level on the second administration of the Start Math test. While not every child made it to grade level on the retest, the majority of the students made significant increases on their second scores. The RtI strategies that were put in place for the students, as well as additional training and support for the teachers of those tier two intervention students, had a positive impact on student test scores. A discussion of the findings is provided in Chapter 5

Chapter 5 Summary, Conclusion, and Recommendations

Chapter 5 is divided into five sections: (a) overview of the study; (b) interpretation of findings; (c) implications for social change; (d) recommendations; and (e) conclusion.

Overview

Initiated in 2001, the NCLB mandates a significant educational reform with the goal being to improve the academic achievement of all students based on their performance on standardized assessments (Finn, 2004). High-stakes testing and accountability are two of the most significant issues facing today's schools (Jacobson, 2001). With the reauthorization of the Elementary and Secondary Act of 1965 in January 2002, improving student achievement and changing the culture of America's schools became the focus of our nation.

In this study, the researcher implemented a single subject experimental design to determine the effectiveness of a tier two intervention on fifth-grade students who fell one grade level below on the Star Math test. An analysis of the fall 2013 Star Math test data was conducted as a pretest (initial test scores) and posttest administered in January of 2014 (retest scores). A paired t test was used to determine differences among the two test administrations. The treatment protocol, which consisted of: (a) small group instruction (10 students) and (b) computer based instruction in Mathematics through the use of SuccessMakers Mathematics. Several critical features define the participants for this study: (a) all students were in 5th grade; (b) all students were regular education students;

and (c) all students failed to meet grade level on the Star Math Assessment and were in danger of falling one grade level below their grade.

Research question

Will the implementation of a Tier 2 math intervention, SuccessMakers, (independent variable) allow for growth in individual math skills (dependant variable) with a student that has been identified as struggling with math skills in order to be on grade level or within a year of grade level math skills?

Review of Methods

Research supporting the method selected for this type of intervention protocol indicate that the vast majority of math problems can be prevented when students in the primary grades are provided with quality classroom math instruction along with additional small-group intervention when needed (Mathes & Denton, 2002; Torgesen, 2000).

All intervention teachers had small groups of 10 students. The students were grouped according to their Star Math test score that fell below actual grade level. The math intervention class lasted 30 minutes daily for 4 weeks.

The researcher supervised the implementation of the protocol by teaching the intervention teachers how to ensure the students were able to access the SucessMakers Math program through the computer.

Summary of Findings

The information derived from this study indicates that the fifth-grade students who participated in academic intervention improved their math scores on the second Star

Math administration. The paired t test showed that prior to the intervention program, student scores had a mean score of 4.18. That increased to a mean of 5.35 after the intervention program. The change in Star Math test scores for participants in the program was significantly higher for math scores from the initial test administration to the retest administration ($t = 4.690$ $df = 9$, $p = .001$). This increase is statistically significant, resulting in the acceptance of the alternative hypothesis, which indicates that the academic intervention program with the addition of the protocol is effective in increasing student Star Math Test scores.

The individual student results for 8 of the 10 students using the progress monitoring of SuccessMakers Math Program revealed a moderate to large effect size which adds to the demonstration and effectiveness of SuccessMakers as a tier II intervention for students that are struggling to make grade level progress in mathematics and fall 1 grade level below their current grade level.

The two students that made moderate gains would benefit from additional sessions utilizing the same intervention before determining if additional interventions are needed for students 3 and 6 to make adequate gains in mathematics.

Student 4 would benefit from a more targeted math intervention since his progress was minimal at best. While student 5 made sporadic progress throughout the intervention, even though he completed all 20 sessions he was checked out early from several of the sessions which could have lead to his intermittent performance. As a result he would benefit from another round of intervention utilizing SuccessMakers Math. The

intervention team could possibly pull him in the morning to take out the variable of him being checked out of school early.

The findings from the study indicate a significant increase in student learning when additional RtI strategies are utilized in the regular education setting for students failing to make grade level progress in Mathematics. The data supports that RtI strategies in mathematics would be beneficial if implemented in classrooms in which students are failing to make adequate academic gain. As a result of this study it is determined that students who are at a higher risk of falling behind may require additional strategies that address individual skill weaknesses but not to such a degree that special education is needed. The training needed to implement RtI is minimal, yet the advantages are monumental.

Implications for Social Change

The researcher will meet with the Director of Special Education and the Charter School Administration to discuss the implications of the data. The academic intervention program in this study was found to have significant impact on the math achievement levels of the fifth-grade students that were falling one grade level below in mathematics. The addition of the intervention protocol will enhance the student achievement of students' math skills. The protocol can be adapted by grade level for grades K-9 with very little extra effort on the teacher's part.

The school and school system will also begin to implement the RtI strategies used in SuccessMakers Math intervention for all low-performing students in elementary schools. RtI benefits most students struggling in math by focusing on the best possible

teaching approach, which can be administered within the context of a regular education classroom (Grigorenko, 2009). RtI is a general and special education tool that was developed from a need to forestall the number of students referred to special education. Levels of interventions put in place that consistently monitor and intervene for specific skills deficits have been shown to be effective for the majority of students.

The Charter School system will utilize the results of this study to provide professional learning on specific math interventions to be used in the regular education classrooms. The strategies and interventions will be accessible to all identified students who have skill deficits in order to increase student achievement.

The Charter School that is located in the Northern, United States will implement Action Plans for all students that fell one grade level below on the Star Math Test. The Action Plan documents a plan for intervention for all students who did not meet grade level on the Star Math Test. The Action Plan committee, which will consist of a school level administrator, the special education administrator, school psychologist, intervention teacher, and regular education teacher, will discuss the goals and objectives, any improvement in test scores, and then determine if the student should continue with the intervention. The Action Plans are a direct result of the compilation of this study's data. The protocol, coupled with specific intervention tools, and protocols, provide sufficient information to assist the committee in determining if the student is making academic gains in the documented area of academic deficits.

The results of the study are not unique to the general education population. Historically, the research has focused primarily on reading intervention. Indicating that

students that received an intervention program consisting of supplemental small-group instruction for a minimum of five times a week for 35 minutes each session, performed higher on reading assessments (Hughes & Dexter, 2008). Additionally, Hughes and Dexter (2008) noted that of eleven studies that reviewed the effectiveness of RtI, all programs that implemented RtI interventions showed some level of academic improvement for at-risk students. According to the NASDSE (2005), response to quality intervention promotes effective practices in schools and helps close the achievement gap for struggling students. The idea has been that a student who responds to the protocol and progresses at an acceptable rate is not "disabled" and therefore does not need to be separated from the peer group for instruction (Fuchs & Fuchs, 2001).

With the reauthorization of the NCLB Act, and IDEA it is the responsibility that educators leave no child behind academically, as a result schools across the nation need to implement programs that are successful in increasing student academic achievement. Because of the statistically significant gains fifth-grade students had in the Star Math retest scores, it is recommended that the stakeholders who have the power to implement changes within the local school system utilize the research-based protocol in all regular education classes.

When the United States Department of Education created the new guidelines for identifying learning disabilities that allowed for school systems to adopt the RtI method in lieu of or in addition to the IQ-achievement discrepancy model, school system's across the United States have been slow to respond as a result of educators have been left to interpret the legislation leading to allowing for own school districts to make decisions on

how to structure RtI and ensure that students who are at risk are provided the opportunities to become successful (Carney and Stifel 2008). This study, along with future research in the field of RtI will allow the Department of Education, local school districts, and other educational leaders to evaluate the RtI process and establish protocols for its use in schools across the country to improve student achievement in mathematics, ultimately effecting social change.

Without relevant and current research on the RtI model many school systems across the country will continue to utilize the IQ-achievement discrepancy model, leading to the perpetuation of students that are failing to make adequate academic gains to fall through the cracks. As a result these students will continue to struggle because they do not qualify to receive specialized instruction (Ukrainetz, 2006). With the implementation of RtI in schools it will allow the students that are struggling to have the opportunity to participate in academic interventions that are aimed at skill deficits. With the targeted intervention, the students will be able to improve in their deficit areas and advance their educational performance which in turn will allow them to have greater opportunities in the future and become productive members of our society.

Society is continuously evolving and just as society evolves so must the field of education. The transformations are made so students will continue to show improvements in the abilities and knowledge in order to stay on the cutting edge and maintain our progress in the global community as successful members of society.

Recommendations for further study

Based upon the findings of this study, the following recommendations are made for researchers:

1. This study took place for a limited amount of time. It could possibly be more beneficial if the study was implemented for a longer period of time. This study focused on a 4 weeks of data which was 20 school day intervention period. By implementing the protocol for a semester (45 school days), teachers would be able to isolate more specific skill deficits to address through the intervention. The remediation protocol would be presented in all grades at the elementary level, encompassing four times the number of original participants.
2. Due to the fact that this study was limited to a single Charter School in Northern, United States and focused on one small population, it will be difficult to replicate this study. It is suggested that an additional study that focuses on a larger sample to include all elementary (K-6) students in the study would lend itself to a greater understanding of the academic effects of the intervention on a larger scale.
3. It would be interesting to study how RtI strategies affect student motivation for learning, given the fact that motivation has been shown to positively affect achievement (Marzano, 2003). It is important to note that students in intervention have failed to make grade level performance in Math and were chosen to participate in a retest. Researching the students' sense of failure versus motivation would provide more insight into the impact of the intervention (Marzano, 2003; Thompson, Thompson, & Thompson, 2002)

4. The initial study's results indicate a significant impact on student learning. Adding a control group to this study would provide additional data and another layer to the depth of the study.

Conclusion

A great deal of work remains in the area of improving student achievement on high-stakes tests and closing the achievement gap in mathematics. The RtI program is one attempt by many schools and districts to meet the expectations set forth in NCLB. As a result of the rigorous standards that have been established, and standardized tests have been created to measure student progress on the standards. The primary goal of the RtI program is to provide intense, research-based instruction to all students, who did not meet the grade level progress as measured by the Star Math test. By implementing small class sizes, providing quality teacher training on RtI strategies, teaching those strategies in the classroom, and modeling the RtI strategies on a daily basis, the goal of the program is to move those struggling learners to areas of proficiency in mathematics. This study, and other research within this paper, indicates that the academic intervention program is effective.

The implication for change with the current program curriculum is significant. Students would be able to participate within the general education classroom if the intervention strategies were consistently implemented. The intervention program currently begins immediately after the fall administration of the Star Math test. This pre-identification of intervention participants has resulted in some students being targeted for intervention because they "may" fail the initial assessment. While there is no method to

accurately identify students who “may” fail the initial Star Math and thus must attend intervention, implementing RtI within all classes throughout the school year would certainly provide a more solid knowledge and skill base for all students.

This research will also provide educational systems, administrators, and special educators that determine which students that qualify for specialized instruction a successful math intervention that allowed for student's to make academic gains in a short amount of time. Special educators, and administrators should pay careful attention to research in this area to help with the implementation of RtI interventions. Bergstrom (2008) argued that successfully adopting and implementing an RtI model goes far beyond progress monitoring and utilizing scientifically based interventions; it requires a comprehensive school wide system reform as well as a paradigm shift with educators about how to provide students who are struggling the most effective interventions available.

According to Berkeley, Bender, Peaster, and Saunders (2009), only 15 states were fully implementing RtI models. Therefore, other schools across the country could look at the results of this study as well as future research to aid in determining the most effective method of providing successful math interventions to students who are struggling to make academic gains. Ultimately allowing for new implementation of special education standards for all school systems. The data from this study will also support RtI as an effective way to support and improve student achievement in the area of mathematics.

The Special Education Director and the researcher will continue to look to research and data for answers to the many questions the programs create. Further research

to help determine what RtI math strategies that are appropriate for regular education students and the amount of time needed for the intervention protocol to be effective in the intervention program will prove valuable to all stakeholders.

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Education of the Handicapped Act Amendments of 1986, Pub. L. No. 99-457, 20 U.S.C. §1400 et seq.

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Appendix A: Parental Permission Form

Quest Academy Charter School

TITLE OF STUDY: Investigating the Effects of a Tier II intervention SuccessMakers Math as a Strategy for Students with Difficulties in Mathematics

INVESTIGATOR(S): Mrs. Jennifer Calcut and Dr. Timothy Lionetti (Doctoral Committee Chair)

CONTACT PHONE NUMBER: 801-430-3911 (Mrs. Calcut) or (Dr. Lionetti)

Purpose of the Study
Your child is invited to participate in a research project. The purpose of this study is to explore the effectiveness of a computer based mathematics interventions designed to help students that are struggling in mathematics make adequate academic gains that are commensurate with their grade level.

Participants
Your child is being asked to participate in the study because he/she needs help with math.

Procedures
If you allow your child to volunteer to participate in this study, the scores your child earns on a pretest, posttest, and daily computer based programs will be shared with the investigator. Your child will receive daily instruction on a computer based math intervention program SuccessMakers Math for 30 minutes. The pre-test and post-test measures will be used in the study to determine if the intervention was effective in helping your child that is currently struggling with mathematics.

Benefits of Participation
There *may* be direct benefits to your child as a participant in this study. Allowing the investigator to analyze your child's mathematics performance using the tests and computer based interventions he/she completes will help inform his/her teacher about the effectiveness of the intervention that is being provided to your child. This information will help plan future mathematics interventions to better address your child's educational needs.

Risks of Participation
There are risks involved in all research studies. The risks associated with this study are minimal. It is possible that your child may experience minimal stress or discomfort related to the sharing of the test scores if he/she makes errors on some o the problems.

Cost/Compensation

There will not be financial cost to your child to participate in this study. There will be no compensation.

Contact Information
If you or your child have any questions or concerns about the study, you may contact Mrs. Jennifer Calcut at 801-430-3911 or Dr. Timothy Lionetti at . For questions regarding the rights of research subjects, any complaints or comments regarding the manner in which the study is being conducted you may contact the Walden University Office for Protection of Research Subjects at _____.

Voluntary Participation
Your child's participation is this study is voluntary. Your child may refuse to participate in this study or in any part of this study. Your child may withdraw at any time without prejudice to your relations with the university or Quest Academy Charter School. You or your child are encouraged to ask questions about this study at the beginning or any time during the research study.

Confidentiality
All information gathered in this study will be kept completely confidential. All records will be stored in a locked facility at Quest Academy Charter School for three years after completion of the study.

Parent Permission
I have read the above information and agree to ALLOW MY CHILD TO participate in this study. I am at least 18 years of age. A copy of this form has been given to me.

_____ _____
Signature of Parent Date

_____
Parent Name (Please Print)

_____
CHILD'S NAME

Appendix B: Student Assent Form

Hello,

My name is Mrs. Calcut, and I am doing a research project to learn about ways to help children learn math. I am inviting you to join in my project. I am inviting you because your recent Star Math scores tell me that you need some help with math. I am going to read this form to you because I want you to learn about the project before you decide if you want
to be in it.

ABOUT THE STUDY:
If you choose to be part of the study, this is what will happen:

1. All of the students will come participate school wide in the Star Math test.

2. After everyone has taken the test, I will be contacted by your teacher to provide extra math instruction for 30 minutes daily for 4 weeks.

3. For 4 weeks, one of the groups will come to the computer lab Monday through Friday for 30 minutes to use the SucessMakers math program on the computer. I will show you how it works, and once you understand how it works you will be able to do it yourself most of the time. There are a few parts of the program that I will need to help you with, but I or staff will be there in the computer lab with you the whole time in case you get stuck or have any questions.

4. After the 4 weeks, all of the students will come back to my room one at a time to take the Start Math test again.

5. Then the project is over. I will be able to look at all of the scores on the math tests to figure out if the math program really helps gain math skills. If it does, all of the students in the school who need some help with Math will be able to use this math program to help them.

IT'S YOUR CHOICE:
You don't have to be in this project if you don't want to. You won't get into trouble with anyone at the Quest Academy Charter School if you say no. If you decide now that you want to join the project, you can still change your mind later. If you want to skip some parts of the project, just tell me.

If you decide to be in this project and you are in the computer lab group, you might miss some lessons or activities in your classroom. I will talk to your teacher to make sure she

sets aside anything you missed during that time. But this project might help others by helping them figure out the best ways to help kids learn math. There is no compensation for being in this study.

PRIVACY:
Everything you tell me during this project will be kept private. That means that no one else will know your name, what answers you gave, or how you did on the testing and on math program. The only time I have to tell someone is if I learn about something that could hurt you or someone else.

ASKING QUESTIONS:
You can ask me any questions you want now. If you think of a question later, you or your parents can reach me at 801-430-3911. If you or your parents would like to ask my university a question, you can call Dr. Timothy Lionetti. His phone number is -_____then dial _____.

Thank you very much for taking the time to learn about my study! I will give you a copy of this form. Please sign your name below if you want to join this project.

Name of Child _____

Child's Signature _____

Date _____

Researcher's Signature _____

Curriculum Vitae

Jennifer Calcut

EDUCATION

Walden University, Minneapolis Minnesota
Anticipated Ph.D. in Clinical/School Psychology ABD currently enrolled
Dissertation: Effects of SuccessMakers Math as an Intervention for Students

Utah State University, Logan, Utah
B.S. Special Education Mild/Moderate Teaching Endorsement 2004

Utah State University, Logan, Utah
M.S. Special Education/Rehabilitation Counseling 1998

Utah State University, Logan, Utah
B.S. Psychology 1996
Minor: Family, Consumer, and Human Development

Licenses
Licensed Associate Professional Counselor, LAPC (Current)
Licensed State Social Worker, SSW (Current)
Licensed School Psychologist (current)
Licensed Special Education Teacher K-12 Mild/Moderate Endorsement (current)
Licensed Foster Parent (current)
Certified Rehabilitation Counselor, CRCC (expired)

TEACHING EXPERIENCE

School Psychologist Weber School District & Quest Academy Charter School
Highly Qualified teacher in Mild/Moderate Special education, Level 2 Certified School Psychologist 2010-current
Teach a variety of students with a wide range of disabilities, making lesson plans, behavioral planning, conducting functional behavioral assessments, accommodating testing, and administering criterion referenced testing. Taught social skills, English, reading, phonics, mathematics, and bullying programs.

Special Education Teacher Weber School District
Highly Qualified teacher in Mild/Moderate Special education 2004-2010

Teach a variety of students with a wide range of disabilities, making lesson plans, behavioral planning, conducting functional behavioral assessments, accommodating testing, and administering criterion referenced testing. Taught social skills, English, reading, phonics, mathematics, and bullying programs.

Teaching Assistant-to Professor in Intro to Psychology (PSY 101) 1996
Teach basic psychology principals and assist with labs to undergraduate students registered for PSY 101

RELATED EXPERIENCE

Quest Academy Charter School, West Haven, Utah
School Psychologist 2011 – Current
Provide counseling, instruction, and mentoring for those struggling with social, emotional, and behavioral problems. Increase achievement by assessing barriers to learning and determining the best instructional strategies to improve learning. Promote wellness and resilience by reinforcing communication and social skills, problem solving, anger management, self-regulation, self-determination, and optimism. Enhance understanding and acceptance of diverse cultures and backgrounds. Identify and address learning and behavior problems that interfere with school success. Evaluate eligibility for special education services (within a multidisciplinary team)Support students' social, emotional, and behavioral health. Teach parenting skills and enhance home–school collaboration. Make referrals and help coordinate community support services. Identify and resolve academic barriers to learning. Design and implement student progress monitoring systems. Design and implement academic and behavioral interventions Support effective individualized instruction. Create positive classroom environments Motivate all students to engage in learning. Collect and analyze data related to school improvement, student outcomes, and accountability requirements. Implement school-wide prevention programs that help maintain positive school climates conducive to learning. Promote school policies and practices that ensure the safety of all students by reducing school violence, bullying, and harassment. Respond to crises by providing leadership, direct services, and coordination with needed community services. Design, implement, and garner support for comprehensive school mental health programming Coordinate the delivery of services to students and their families in and outside of school Help students transition to and from school and community learning environments, such as residential treatment or juvenile justice programs.

Maria Montessori Academy Charter School, North Ogden, Utah
School Psychologist 2011 – Current
Evaluate eligibility for special education services (within a multidisciplinary team) Support students' social, emotional, and behavioral health. Teach parenting skills and enhance home–school collaboration. Make referrals and help coordinate community support services. Identify and resolve academic barriers to learning. Design and

implement student progress monitoring system. Design and implement academic and behavioral interventions

Weber School District, Valley View Elementary, Lakeview Elementary, Municipal Elementary, Whalquist Jr. High, & Fremont High School Weber County, Utah
School Psychologist 2009 - 2012
Provide counseling, instruction, and mentoring for those struggling with social, emotional, and behavioral problems. Increase achievement by assessing barriers to learning and determining the best instructional strategies to improve learning. Promote wellness and resilience by reinforcing communication and social skills, problem solving, anger management, self-regulation, self-determination, and optimism. Enhance understanding and acceptance of diverse cultures and backgrounds. Identify and address learning and behavior problems that interfere with school success. Evaluate eligibility for special education services (within a multidisciplinary team) Support students' social, emotional, and behavioral health. Teach parenting skills and enhance home–school collaboration. Make referrals and help coordinate community support services. Identify and resolve academic barriers to learning. Design and implement student progress monitoring systems. Design and implement academic and behavioral interventions Support effective individualized instruction. Create positive classroom environments Motivate all students to engage in learning. Collect and analyze data related to school improvement, student outcomes, and accountability requirements. Implement school-wide prevention programs that help maintain positive school climates conducive to learning. Promote school policies and practices that ensure the safety of all students by reducing school violence, bullying, and harassment. Respond to crises by providing leadership, direct services, and coordination with needed community services. Design, implement, and garner support for comprehensive school mental health programming. Coordinate the delivery of services to students and their families in and outside of school. Help students transition to and from school and community learning environments, such as residential treatment or juvenile justice programs.

Sutton Clinical Services, Ogden, Utah
Associate Professional Counselor/Clinical Psychology Intern 2009-Current
Work with individuals, families, and groups to address and treat mental and emotional disorders and to promote mental health. Trained in a variety of therapeutic techniques used to address issues such as depression, anxiety, addiction and substance abuse, suicidal impulses, stress, trauma, low self-esteem, and grief assist with job and career concerns, educational decisions, mental and emotional health issues, and relationship problems. Involvement in community outreach, advocacy, and mediation activities specialized in delivering mental health services for the children with a variety of mental and physical disabilities as well as trauma related developmental delays trained in administration and interpretation of psychological assessment that includes; cognitive, behavioral, academic, language, personality and emotional assessments.

Trained in nuerofeedback. Apply family systems theory, principles, and techniques to address and treat mental and emotional disorders. In doing so, allowing the individual's to modify people's perceptions and behaviors, enhance communication and understanding among family members, and help to prevent family and individual crises.

SIPAPU, Northern/Wasatch Front, Utah
Conflict of Interest Investigator of Child Abuse for the State of Utah 2006-2008
A contracted independent CPS caseworker that assess the threats of harm, the child's vulnerabilities, and the protective capacities of the caregiver, and will then take steps to ensure the safety of any child in the home. Completed child abuse investigations on providers that were licensed with the State of Utah to provide care for children in Foster Care throughout the Salt Lake, Davis, Weber, and Box Elder Counties. Responding to children and families in need of support and help undertaking enquiries following allegations or suspicion of abuse undertaking initial assessments and core assessments as part of the Assessment Framework convening strategy meetings and initial and subsequent child-protection conferences court action to safeguard and protect children coordinating the implementation of the child protection plan for children on the child protection register looking after and planning for children in the care of the council ensuring that looked-after children are safeguarded in a foster family, children's home or other placement.

Weber School District, West Haven Elementary, West Haven, Utah
Level 2 Mild/Moderate Special Education Teacher 2005-2010
Work with students with severe cognitive, emotional, or physical disabilities, primarily teaching them life skills and basic literacy. Modifying the general education curriculum to meet the child's individual needs and providing required remedial instruction.
The various types of disabilities that may qualify individuals for special education programs are as follows: specific learning disabilities, speech or language impairments, mental retardation, emotional disturbance, multiple disabilities, hearing impairments, orthopedic impairments, visual impairments, autism, combined deafness and blindness, traumatic brain injury, and other health impairments. Use of various techniques to promote learning. Depending on the student, teaching methods can include intensive individualized instruction, problem-solving assignments, and small-group work. When students need special accommodations to learn the general curriculum or to take a test, special education teachers ensure that appropriate accommodations are provided, such as having material read orally or lengthening the time allowed to take the test. Develop an Individualized Education Program (IEP) for each student receiving special education. The IEP sets personalized goals for the student and is tailored to that student's individual needs and abilities. When appropriate, the program includes a transition plan outlining specific steps to prepare students for middle school or high school or, in the case of older students, a job or postsecondary study. Review the IEP with the student's parents, school administrators, and the student's general education teachers.

Work closely with parents to inform them of their children's progress and suggest techniques to promote learning outside of school. Design and teach appropriate curricula, assign work geared toward each student's needs and abilities, and grade papers and homework assignments. Involvement in the student's behavioral, social, and academic development, helping them develop emotionally and interact effectively in social situations. Help general educators adapt curriculum materials and teaching techniques to meet the needs of students with disabilities. Coordinate the work of teachers, teacher assistants, and related personnel, such as therapists and social workers, to meet the individualized needs of the student within inclusive special education programs. communicating and coordinating with others involved in the child's well-being, including parents, social workers, school psychologists, occupational and physical therapists, school administrators, and other teachers.

Division of Child and Family Services, Ogden, Utah
Northern Region Independent Living Coordinator and Foster Care Supervisor 2004-2005

Supervise a team of foster care workers that worked with children in foster care transitioning to independent living. Supervised the Northern Region Independent Living Dorm develop a relationship with the child through visits, telephone calls and private conversations, as age appropriate explain the purpose of the Service Plan and planned activities to the child, as appropriate for the child's level of understanding
help the child understand the reasons for and the realities of placement without violating the positive aspects of the child's feelings about his/her parents.
Keep the child informed about the his/her case planning, family situation and siblings ensure the child's visitation with parents, siblings and significant persons according to the Service Plan. Ensure that family photographs and other mementos of the child's life are gathered and preserved. These items shall reflect the various family and life experiences of the child and should be maintained in a Life Book format. Allow the child the opportunity to express his/her anxieties, fears and other feelings, including conflicted loyalties. Ensure through observation and direct inquiry that all the child's basic needs are met arrange for any special services the child may require including health, mental health and educational aid in preparing the child for any life transitions, adoption, reunification, adulthood ensure that a full array of adolescent services are provided to all youth over the age of sixteen (16) document the child's progress by maintaining the uniform case record and LINK computer record.

Division of Child and Family Services, Ogden, Utah
Child Protective Service Worker Specialized and Certified Child Sex Abuse Investigator 1998-2004

Responding to children and families in need of support and help. Undertaking enquiries following allegations or suspicion of abuse. Undertaking initial assessments and core assessments as part of the Assessment Framework convening strategy meetings and initial and subsequent child-protection conferences, court action to safeguard and protect

children. Coordinating the implementation of the child protection plan for children on the child protection register looking after and planning for children in the care of the council ensuring that looked-after children are safeguarded in a foster family, children's home or other placement.

Division of Child and Family Services, Ogden, Utah
Foster Care Worker 1997-1998
Develop a relationship with the child through visits, telephone calls and private conversations, as age appropriate explain the purpose of the Service Plan and planned activities to the child, as appropriate for the child's level of understanding.
Help the child understand the reasons for and the realities of placement without violating the positive aspects of the child's feelings about his/her parents. Keep the child informed about the his/her case planning, family situation and siblings ensure the child's visitation with parents, siblings and significant persons according to the Service Plan.
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Co-Founder/Educational Outreach, Police Wives of Utah 2011 to Current
Provide educational support and outreach to fellow officers families.

Related Course Work and Conferences
Medical Aspects of Disability
Rehabilitation and Mental Illness
Legal Aspects of Special Education
Psychopharmacology
Trauma-Focused Cognitive Behavioral Therapy
American Prosecutors Research Institute's National Center for Prosecution of Child Abuse Finding Words Certification: Interviewing Children and Preparing for Court
United States Department of Justice Office of Justice Programs; Officer of Juvenile Justice and Delinquency Prevention: Training Child Sexual Exploitation Investigations
University of Utah Graduate School of Social Work: Clinical Training Skills; Assessment and Treatment of Clients with Sexual Trauma and Addictions
Child Trauma Treatment Network of the Intermountain West: Reactive Attachment Disorder and other Attachment Problems

United States Department of Justice Office of Justice Programs; Officer of Juvenile Justice and Delinquency Prevention: Training Child Abuse and Homicide Investigations
Social Psychology
Developmental Psychology
Psychology of Personality
Psychology of Learning and Memory
Cognitive Psychology
Tests and Measurements
Advanced Psychological Testing
Ethics and Standards of Professional Practice
Advanced Psychopathology
Theorist of Psychotherapy
Multicultural Counseling
Biopsychology
Psychology of Social Change
Childhood Psychology
Psychology of the Exceptional Individual
Psychological Consultation
Psychological Assessment Cognitive, Behavioral, Personality and Social-Emotional