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The Effectiveness of Reading Interventions for Middle School Students with Learning Disabilities

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This is to certify that the doctoral study by

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Walden University
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Abstract

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Dissertation Submitted in Partial Fulfillment

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Abstract

Students with learning disabilities are often unable to master reading comprehension and often fail to acquire reading comprehension skills at basic levels as measured on reading achievement assessments. Reading intervention programs Compass Learning and SRA Corrective Reading teach students how to apply strategies to their reading to improve their understanding of written text. The purpose of this quantitative ex-post facto research design was to determine the extent to which the reading intervention programs implemented at the research school improved reading achievement scores for seventh grade students with learning disabilities in reading, and to determine how much scores changed from the pretests to the posttests for two intervention groups. The theoretical framework for this study was the cognitive load theory. Data included Scholastic Reading Inventory scores from a convenience sample of 46 seventh grade students with learning disabilities in reading. The data were analyzed using a one-way ANOVA pretest-posttest design. Data analyses indicated statistically significant differences in the reading achievement scores of the student participants, indicating they had higher reading achievement scores after participating in targeted reading interventions. This research contributes to positive social change by motivating students to be actively engaged in their reading and apply the skills they have learned as a result of participating in targeted reading interventions. This research also prepares students for the competitive job market through identifying viable interventions to help improve their reading comprehension skills.

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Dedication

I dedicate this dissertation in memory of my father Anthony Lott (1954-2018) and my mother Connie Lott, who instilled in me the qualities of perseverance and commitment and encouraged me to always strive for excellence in whatever I pursue. I also dedicate this dissertation to my husband Willie, my children Asya, Caleb, and William, and granddaughter Akalyia for their tireless love, and always believing in me, inspiring me, and encouraging me to stay on my path. Always live your best life; don't fear failure, be afraid of not having the chance.

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Lastly, I am appreciative to my school administrators, Dr. Leslie White, Rachel Hurst, and Julian Childers for allowing me to complete my research and provide me with all the support I needed at the school level.

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Chapter 1: Introduction to the Study

Introduction

Since the inception of No Child Left Behind (NCLB) in 2002, students have been tested to assess their reading and mathematics achievement levels as mandated by the federal government. The federal government also requires progress monitoring of student reading and mathematics ability by way of the National Assessment of Educational Progress (NAEP), the nation's report card (Peterson & Ackerman, 2015). The NAEP assesses the reading and math performances of representative samples of students with and without disabilities. Unfortunately across the United States, only 34% of eighth grade students (including those with and without disabilities) were reading at proficient levels in 2015 (National Center for Education Statistics [NCES], 2015). The NAEP reading scores reflect students' general comprehension of a text by tasking them with answering questions that show how well they understand, interpret, evaluate, and connect to the text (Vaughn & Wanzek, 2014). Limited reading and comprehension skills may impeded student success not only in the classroom, but also in society at large Graves, Brandon, Duesberry, McIntosh, & Pyle, 2011). Researchers have consistently concluded that students' failure to learn reading skills is a major cause for long-term remediation, retention, and qualification for special education services (Marchand-Martella, Martella, & Przychodzin-Havis, 2005).

Vaughn and Wanzek (2014) found that students with learning disabilities (LD) in reading generally have low academic growth in their reading performances despite receiving interventions. Researchers have consistently found that interventions for

students with LD must be tailored to their individual needs to ensure they are fully benefiting from the interventions (Moreau, 2014; Spencer, Quinn, & Wagner, 2014; Vaughn & Wagner, 2014). In this study, I investigated the extent that reading achievement scores on the Scholastic Reading Inventory (SRI) improved for students with LD in reading who (a) participated in a direct instruction and computer-assisted reading intervention group, or (b) who participated in a computer-assisted only reading intervention group at the study school. Students with LD make up the largest category of students receiving special education services in the United States, with more than 2.4 million students labeled with this disability category. LD is defined as a psychological processing disorder that involves the understanding or use of language, spoken or written, or in mathematical calculations including conditions such as dyslexia, brain injury, perceptual disabilities, minimal brain dysfunction, and development aphasia (U.S. Department of Education, 2016). Students with LD often struggle with underachievement not directly related to cultural factors, environmental or economic disadvantages, or inadequate instruction. The most common types of LD that affect students are in the areas of reading (dyslexia), math (dyscalculia), and writing (dysgraphia; Cortiella & Horowitz, 2014). This study may aid educators in determining the best interventions for addressing reading difficulties for students with LD who struggle with reading comprehension. This chapter addresses the purpose of the study, the research questions that guided the study, the theoretical framework for the study, the nature of the study, and the significance of the study.

Background

Reading is one of the most important skills students can develop throughout their lives, and reading comprehension is the cornerstone for reading (Lan, Lo, & Hsu, 2014). Unfortunately, an alarming number of students are not reading or comprehending at proficient levels. In schools across the United States, Common Core State Standards have been established in the area of reading to provide guidance for what students should understand and be able to implement at each grade level (Peterson & Ackerman, 2015). Despite the federal government's goal to lessen the number of poor readers, a multitude of students at the middle school level still struggle with reading comprehension, making it exceedingly difficult for them to keep up with the demands of grade-level content classrooms (NCES, 2015; Swanson, Wanzek, Vaughn, Roberts, & Fall, 2015). The persistent trend of poor reading achievement for students is an issue in schools across the United States. Effective research-based interventions are needed to support students in their learning of reading.

The National Reading Panel (2017) has recommended effective instruction in phonics, phonemic awareness, fluency building, vocabulary, and text comprehension for students who are struggling readers. Explicit instruction is recommended for improving word recognition, spelling skills, and the reading comprehension skills of struggling readers (Cheung & Slavin, 2013). Although students vary in their reading skills and cognitive ability, it is important that educators identify and target their reading interventions to address individual weaknesses. Providing effective interventions using direct instruction, computer-assisted instruction, or a combination of both may help

address the needs of struggling readers. At the study school, students with LD in reading were struggling with reading comprehension skills as indicated by their reading achievement scores on the SRI. They were then placed in either a direct instruction and computer-assisted reading intervention group or a computer-assisted reading intervention group based on their identified level of need via the SRI reading assessment. The reading intervention groups ranged in complexity depending on the needs of the students and their varying reading comprehension deficits. Students who received the dual interventions of direct instruction and computer-assisted instruction were reading far below seventh grade level expectations (two grade levels or more), and students who received the computer-assisted intervention only were reading below seventh grade level expectations (one grade level).

Problem Statement

In the United States, students in middle school are reading at basic or below basic levels (Nations Report Card, 2016). A lack of highly developed reading skills negatively affects the academic and social lives of struggling readers. In a suburban middle school in southeastern United States that served as my research site, students with LD in reading are struggling with reading comprehension skills. The problem is that teachers and administrators do not know if the reading intervention programs implemented at the research school are meeting the intended goal of increasing reading achievement scores. According to the 2013 NAEP, 69% of fourth grade students and 60% of eighth grade students with disabilities scored below a basic reading level, placing them well below grade level expectations (Solis, Miciak, Vaughn, & Fletcher, 2014). Of the estimated

13% of students receiving special education services throughout the United States, 50% are categorized as learning disabled, with 80% receiving special education services for reading (Washburn, Joshi, & Binks-Cantrell, 2011). Students with reading deficits may struggle with the basic comprehension of literal, explicitly stated information, and with identifying main ideas from the texts (Faggela-Luby & Wardwell, 2011). Struggling readers are not able to fully integrate information from multiple texts or critically evaluate complex texts that are unfamiliar to them, resulting in misinterpretations or confusion (Kelly, Nord, Jenkins, Chan, & Kastberg, 2013). Reading comprehension is a multifaceted skill that many students with LD in reading do not possess, and the needed skills vary by text form, genre, reader ability, prior knowledge, and reading goals (Lan et al., 2014). It is essential that students with LD in reading receive effective reading interventions to increase their reading achievement scores.

The main goal of reading is comprehension (National Institute of Child Health and Human Development [NIH], 2013). To comprehend written text, students have to construct a rational mental picture of text and connect and integrate current information with background knowledge or with information that appeared either earlier in the text (McMaster, Espin, & van den Broek, 2014). Many students with LD struggle with reading comprehension. However, effective interventions that include direct instruction of specific reading strategies that are applicable and efficient for their individual reading situation can help address students' reading struggles (Botsas, 2017).

Reading assessments are often implemented to determine the reading comprehension levels of students. The SRI is a reading comprehension assessment that

measures students' reading comprehension by concentrating on the skills readers use to understand written materials sampled from various content areas (Scholastic, 2014). Data derived from the SRI reading assessment may help teachers focus their intervention strategies for effective reading comprehension instruction (Fuchs, Fuchs, & Compton, 2010).

In the local school setting, students struggling with reading comprehension skills participated in reading interventions of varying complexities ranging from direct instruction to computer-assisted instruction to help teachers address the growing issue. My aim in this research study was to determine if the two interventions improved reading achievement scores and to determine if there was an improvement in the student participants' reading achievement scores from pretest to posttest for the two intervention groups.

Purpose of the Study

The purpose of this study was to examine the extent that each reading intervention strategy was meeting its intended goal of increasing reading achievement scores. I also sought to determine how reading achievement scores differed from pretest to posttest for the two intervention groups. Direct instruction and/or computer-assisted interventions are the commonly used methods for narrowing the achievement gap for students with LD and others who struggle with reading. School leaders can use this research to aid in determining the best reading interventions to implement to assure the best use of reading resources (Lenhard, Baier, Endlich, Schneider, & Hoffman, 2013).

Research Questions and Hypotheses

I used the following research questions and its corresponding hypotheses to guide this study:

RQ1: To what extent did reading achievement scores increase for student participants who participated in the dual reading interventions, SRA (direct instruction) and Compass Learning (computer-assisted), and for students who participated in a single reading intervention, Compass Learning (computer-assisted), at the middle school level?

$H_0$1: Students who participated in the dual reading interventions, SRA (direct instruction) and Compass Learning (computer-assisted), and the single reading intervention, Compass Learning (computer-assisted), will not have a significant increase in their reading achievement scores.

$H_1$1: Students who participated in the dual interventions, SRA (direct instruction) and Compass Learning (computer-assisted), and the single reading intervention, Compass Learning (computer-assisted), will have a significant increase in their reading achievement scores.

RQ2: How did student reading achievement scores change from pretest to posttest for participants in the dual reading interventions (i.e., SRA-direct instruction and Compass Learning computer-assisted)?

$H_0$2: Students who participated in the dual reading interventions SRA (direct instruction) and Compass Learning (computer-assisted) will not have an increase in their reading achievement scores from pretest to posttest.

$H_1$2: Students who participated in the dual reading interventions SRA (direct instruction) and Compass Learning (computer-assisted) will have an increase in their reading achievement scores from pretest to posttest.

RQ3: How did student reading achievement scores change from pretest to posttest for participants in the single intervention (i.e., Compass Learning-computer assisted)?

$H_0$3: Students who participated in a single reading intervention, Compass Learning (computer-assisted), will not have an increase in their reading achievement scores from pretest to posttest.

$H_1$3: Students who participated in a single reading intervention, Compass Learning (computer-assisted), will have an increase in their reading achievement scores from pretest to posttest.

Theoretical Framework for the Study

Learning requires the interchange of various activities that include memory systems, learning processes, and varying types of cognitive load imposed on working memory (Young, Van Merrienboer, Durning, & Cate, 2014). Cognitive load theory (CLT), an information processing theory that originated in the 1980s, is an integration of knowledge about the structure and function of the human cognitive system with principles of instructional design (Gerjets, Scheiter, & Cierniak, 2008; Schnotz & Kurscher, 2007).

CLT is influential in the field of education because of its emphasis on instructional design and the cognitive processing abilities of learners. CLT is founded on the belief that instructional resources should be aligned with the learners' limited

cognitive abilities in order to limit cognitive load and thus lead to effective higher-level cognitive processes (Gerjets et al., 2008). Reading comprehension is a highly demanding cognitive task that involves a simultaneous process of extracting and constructing meaning (Garcia-Madruga et al., 2013). Reading uses previously required schemas from long-term memory stores, so if a student is having difficulty reading with limited previously acquired schemas, then that student will have great difficulty processing through limited working memory (WM; Chandler & Sweller, 1996). Students with good WM scores typically show good reading comprehension skills on reading comprehension measures, and learners with poor WM scores perform below average on reading comprehension measures. For learners with poor WM, comprehension skills should be explicitly taught with strategies like direct instruction (Garcia-Madruga et al., 2013).

WM is a dynamic processing system that is essential to language comprehension, planning, problem solving, and fluid intelligence. WM connects with relevant prior knowledge activated from long-term memory (Young et al., 2014). WM temporarily stores and manipulates limited amounts of information at a time and is crucial to a learner's ability to acquire knowledge and new skills (Loosli, Buschkeuehl, Perrig, & Jaeggi, 2012). Several researchers have shown that WM is directly related to educational achievement. Learners with poor WM may need additional classroom support to achieve desired goals to improve academically (Loosli et al., 2012). Researchers have also shown that effective WM increased for students by including both visual and auditory WM instead of only visual WM into cognitive processing (Schnotz & Kurscher, 2007). Because learning requires processing information in WM, learning suffers when

cognitive load exceeds the WM of learners (Young et al., 2014).

The CLT supports the idea of individualizing instruction to best accommodate the learner. The CLT encourages educators to take into consideration the learning needs of students based on their abilities and to develop instructional activities that do not stress their overall cognitive load, thereby increasing their chances of attaining higher achievement levels. The CLT will be further explained in Chapter 2.

Nature of the Study

I designed this ex post facto quasi-experimental study to (a) determine the extent that reading intervention strategies improved the reading achievement scores of students, and (b) determine if there was a difference in the reading achievement scores of students with LD in reading as a result of the reading strategies implemented at the research school. This design provided me the opportunity to retrospectively examine how the use of the independent variable (type of reading intervention) influenced the dependent variable (SRI reading achievement scores of students receiving special education services for LD; Williams, 2011). I collected data from archived reading achievement scores of seventh grade students with LD for the 2014-2015 academic year. Because participants were organized into pre-established groups and selection was thus nonrandomized, I used the ex post facto quasi-experimental research design.

Definitions

Cognitive load: Any demands on the working memory storage and processing of information (Schnotz & Kurschner, 2007).

Computer-assisted intervention: An individual-orientated computer program that provides supplemental instruction in reading skills for at-risk children. These programs guide students through sequenced activities according to their individual ability and grade level (Saine, Lerkkanen, Ahonen, Tolvanen, & Lyytinen, 2011; Gibson, Cartledge, & Keyes, 2011).

Corrective reading: A comprehensive reading intervention program designed to help students struggling with reading from grades 4 – 12 and is appropriate for students identified as learning disabled (Institute of Education Sciences, 2013).

Direct Instruction (DI): An explicit, teacher-focused, and well-sequenced approach to teaching critical skills (Shippen, Houchins, Steventon, & Sartor, 2005).

Intervention: An educational program, policy, product, or practice intended to improve student outcomes (Institute of Education Sciences, 2013).

Learning Disabilities (LD): Specific developmental disorders of academic skills often showing poor performance in reading, written expression (including spelling), and mathematics that can not be explained by intelligence or external factors (Buttner & Hasselhorn, 2011).

Reading achievement: The level of understanding a student has with written text (Vaughn et al, 2011).

Reading comprehension: A complex cognitive process that demands individuals to determine meaning by interacting with written language. Reading comprehension requires readers to make connections not only with text but also with their prior knowledge (Watson, Gable, Gear, & Hughes, 2012).

Assumptions

This study included several assumptions related to the study site's interventions and implementation fidelity. I assumed that the teachers responsible for teaching the direct instruction corrective reading program explicitly followed the scripted lessons and suggested reading plan set forth by the SRA program, which were to instruct students at least 45 minutes per day for the duration of 9 weeks (Engelmann et al., 2002). For the students who completed the Compass Learning computer assisted reading intervention, I assumed they completed 2-5 tasks during each 45-minute session per week, as suggested by the research school site. All students who participated in the direct instruction program were students who read at least two grade levels behind, and all students who received only the computer-assisted reading program read one grade level behind. Teachers presumed that the students who read far below grade level needed more intense reading instruction that included both direct instruction and computer-assisted instruction. For students completing the SRI reading level assessment, I assumed the test was given untimed with students having at least 30 minutes to complete with a time lapse of at least 8 weeks to allow for adequate reading growth (Scholastic, 2014). I also assumed that each student who participated in the interventions was fully engaged and motivated to complete the interventions and assessment to their best potential. I expected that all archived data scores would reflect correct score information during that particular point in time and included no errors. My final assumption for this research was that all interventions and assessments were developed, reviewed, and pilot-tested for performance. The school district and research school site administered all of the

interventions and assessments that were implemented in this study, therefore evidence of reliability and validity was assumed to be acceptable.

Scope and Delimitations

The scope of this study was limited to students with LD in the area of reading attending a suburban middle school in the southeastern region of the United States. The study was restricted to a specific school district, school, and seventh grade reading achievement scores. The sample for this study consisted of seventh grade students' reading achievement scores. According to my calculations using the G-Power statistical software program, the sample size for the study needed to consist of approximately 40 students' reading achievement scores with an alpha level set at .05 and a power level set to .95 in order to achieve a significant statistical difference between the comparison groups for the 2014-2015 academic school year (see Faul, Erdfelder, Lang, & Buchner, 2007). Due to the different reading abilities of the students, the students who needed the most intense reading interventions received both direct instruction and computer-assisted instruction. This group consisted of 22 students. Students who needed a less intense reading intervention participated in a computer-assisted instruction intervention; this group consisted of 24 students. Student reading achievement scores not included in the study were scores that did not meet the study requirements (score of 855 and above), scores from students who were not identified as having LD in the area of reading, and scores from students in other grades. The small sample size of 46 students limited generalizability of student outcomes to other suburban schools of similar sizes and demographics.

Limitations

Limitations are the potential weaknesses of a study that could affect the outcomes, such as small sample sizes and errors in measurement (Creswell, 2012). One of the major limitations of this study related to the research design. I used a quasi-experimental research design. The ex-post facto quasi-experimental research design does not involve random sampling for participants, which limits the researcher's ability to draw causal relationships (Rumrill, Cook, & Wiley, 2011). Threats to internal validity included maturation of the student. However, students in each intervention group were maturing at the same rates, lessening the maturation threat (see Lodico, Spaulding, & Voegtle, 2010). The external validity was compromised due to the small sample size; the results of the study may not be generalized beyond the research school site. Another limitation of the research design was that the results derived from the ex-post facto research. Results from quasi-experimental research cannot be used as definitive reasons because they mark *possible* causes or effects (Lodico, Spaulding, & Voegtle, 2010). I obtained the data for this study from archived sources. Therefore, researcher bias did influence study outcomes.

Significance

This research helped me determine if single reading interventions for students with LD were effective, or if a combination of two interventions produced greater reading achievement scores in the area of reading comprehension for students who read below grade level. Those who may potentially benefit from this study included students, teachers, parents, community members, and stakeholders such as principals and school

board members. Other school districts with a similar population and approach to lessening the reading achievement disparity may also benefit from the findings of this research study.

The findings from this research may lead to positive social change because the results contribute to closing a gap in practice and to the literature on best practices for reading interventions to promote increased achievement in the area of reading comprehension. Reducing the amount of time used in the learning environment for remediation using direct instruction and/or computer-assisted instruction reading comprehension can positively affect students by focusing their education on skills such as critical thinking and technology proficiency that are needed to be competitive in the 21st century workforce.

Summary

A staggering number of students do not possess reading comprehension abilities. Being able to read and comprehend proficiently provides students with LD abundant opportunities. Unfortunately, opportunity is limited for those who do not possess reading skills (van de Werfhorst, 2014). Studies have indicated that intense interventions such as direct instruction and computer-assisted interventions help to remediate reading skills. In this study, I examined the extent that reading intervention strategies, both direct instruction with computer-assisted intervention and the computer-assisted intervention alone, resulted in improved reading achievement for students with LD in reading. I also examined the reading achievement score differences from pretest to posttest between the

reading intervention groups. Chapter 2 includes discussion of the theoretical foundation of this research along with an extensive review of the literature.

Chapter 2: Literature Review

Introduction

Reading deficits can negatively affect students. Researchers have consistently shown that students who struggle to read, especially in the early years, are at a higher risk for school failure, emotional and behavioral difficulties, and dropping out of school than students who do not (Cheung & Slavin, 2013; Connor et al., 2014; Worrell, Duffy, Brady, Dukes, & Gonzalez-DeHass, 2016; Williams et al., 2016). Reading comprehension is a cognitively demanding activity that can be daunting for students with reading deficits. Rigorous efforts have been made to lessen the number of students who struggle to read across the United States; however, students often still struggle. Education researchers have long searched for interventions to improve the reading skills of struggling readers, particularly those with LD in reading. At the research school, teachers implemented reading interventions in varying complexities to address the reading deficits of students struggling with reading comprehension skills. By focusing on viable interventions in today's classroom, students with LD in reading have the potential to improve not only their reading skills but also their ability to be productive citizens. This chapter includes sections on the theoretical foundation of the study, WM, learning disabilities, reading comprehension, and computer-assisted instruction. The chapter also includes discussions of how teachers' motivation, attitudes, and beliefs are vital to their level of implementation of technology and interventions.

Literature Search Strategy

I gathered literature related to the topic of study from the Walden University Library using the multidisciplinary database Academic Search Complete and the Google Scholar database. I found relevant peer-reviewed articles in the following journals: *Journal of Exceptional Children, Learning Disabilities Research & Practice, Teaching Exceptional Children, Learning Disability Quarterly, Journal of Behavioral Education, Learning and Instruction, Educational Psychological Review, Reading Research Quarterly,* and *Journal of Special Education.* Keywords used in the literature search included *reading, read, learning disabilities, computer-assisted reading interventions, corrective reading, direct instruction, SRA, Compass Learning,* and *computer interventions*.

Theoretical Foundation

Learning theories are often the basis of effective teaching because they allow educators to take into consideration the varying aspects of the learning process. Learning theorists such as Tolman, Piaget, Vygotsky, Bruner, and Gestalt helped shift ideas about learning from a teacher-centered behaviorist instructional framework to a cognitive framework that views learning as an active process and views learners as active participants in their education (Yilmaz, 2011). In the mid-1950s, cognitive psychologists affected education by emphasizing how cognitive structures and processes change behaviors. Cognitive psychologists were interested in how knowledge was acquired, processed, stored, retrieved, and activated by the learner during the different phases of the learning process because they believed learning happened best when aligned with human

cognitive architecture (Derry, 1996). Cognitive learning theories focused on making learning experiences meaningful for learners by relating the experiences to their prior knowledge (Yilmaz, 2011). Education based on the cognitive framework embraces rich learning experiences for students that are learner controlled and aligned for individual ability levels.

Cognitive Load Theory

The CLT provides an organizing framework for complex events related to human development and learning (Gredler, 2012). Sweller conceptualized the CLT in the late 1970s when he was focusing on students learning to problem solve (Schnotz & Kurscher, 2007). Sweller claimed that without the proper knowledge of how human cognitive processes worked, instruction would be random and possibly ineffective. Sweller argued that traditional instructional techniques did not take into account the limitations of the WM and often overloaded the learner (Schnotz & Kurscher, 2007). The human cognitive architecture is made up of a limited WM and an extended long-term memory. Understanding WM is essential to CLT (Paas, van Gog, & Sweller, 2010). According to the CLT, learning increases expertise by altering long-term memory, and understanding occurs when all relevant elements of information are processed concurrently in the WM (Gerjets, Scheiter, & Cirtniak, 2008).

Supporters of the CLT attempt to integrate knowledge about human cognitive processing with instructional design. Sweller believed that applying the CLT to learning resulted in a better experience for the learner. As the CLT developed, researchers understood the need to match instructional formats with learner expertise for learning to

be successful (Schnotz & Kurscher, 2007). Instructional material that has too many interacting components compromises learning. Learning increases expertise, which in turn reduces cognitive load (Paas et al., 2010). Researchers have proven that cognitive abilities can change with the use of interventions such as direct instruction and working memory training to improve reading comprehension and mathematics learning (Decker, Hale, & Flanagan, 2013). When educators use the CLT, the learning experiences of students with LD in reading are potentially improved.

Working Memory

WM is an essential component of CLT and is influential to learning because it is needed for concept formation. Concept formation involves integrating prior knowledge with new concepts to produce learning (Ayres & Paas, 2012). WM is a dynamic processing system adept at retaining and manipulating small amounts of information used to facilitate comprehension, planning, problem-solving, and reasoning (Cowan, 2014). WM is closely related to an individual's general intelligence and their ability to reason with new information (Garcia-Madruga, 2013). WM is essential to a student's ability to acquire new knowledge and skills; therefore, if the WM capacity is limited, learning does not progress (Loosli et al., 2012). Research by Loosli et al. (2012) showed that WM was directly related to scholastic achievement as evidenced by studies in math, language comprehension, reading skills, and vocabulary development.

Other researchers in the area of WM have found that students with a low WM capacity need additional classroom support to stay on task and achieve goals because of their short attention spans (Loosli et al., 2012). According to the CLT, it is necessary for

learning environments to be relatively free of distractions while teaching because the settings can interfere with learning and occupy WM that could be acquiring new concepts. For students with a low WM capacity, extra effort has to be taken to limit the distractions students are exposed to in a learning environment to prevent students from exceeding their limits (Darabi & Li Jin, 2013). Creating supportive learning environments can aid in the improvement of reading comprehension skills.

Working Memory and Reading Comprehension

Researchers have established relationships between WM and reading comprehension. They have found that students with high WM typically have good reading comprehension skills and students who have poor WM usually have poorer reading comprehension skills. Cowan (2014) reported that WM failures make up a significant portion of the reading comprehension deficits students with LD have. Palladino and Ferrari (2013) demonstrated how WM deficits in children with LD could negatively affect their learning, especially in the area of reading comprehension. Palladino and Ferrari's (2013) research showed that students with LD maintained irrelevant information immediately after reading recall as opposed to children in the control group who showed no discernable effect. Holding on to irrelevant information causes interference with the acquisition of new knowledge; therefore, interference control is necessary when instructing students with LD in areas such as reading comprehension. Garcia-Madruga et al. (2013) conducted a longitudinal study with students aged 8 -11 to determine the relationship between WM and reading comprehension levels. Results of the longitudinal study showed that WM was directly related to the reading

comprehension of the students even after controlling for reading, vocabulary, and verbal abilities (Garcia-Madruga et al., 2013). Employing interventions that have proven to address the limitations of WM, especially for students with LD, is vital to intervention success.

Computer-Assisted Learning and CLT

Computer-assisted learning is becoming increasingly popular in schools across the United States. According to survey research conducted during 2007-2008 on American K-12 education, over 1 million students were being taught using online and blended courses (Picciano, Seaman, Shea, & Swan, 2012). As a result of the survey data, Picciano et al. (2012) estimated that within the next 5 or 6 years over 5 million students will be accessing courses using online and blended learning. Picciano et al. (2012) also found from the survey data that approximately 35% of online or computer-assisted instruction was used for remediation purposes. They inferred that many students who access online learning are adolescents who have demonstrated limited academic success (Picciano et al., 2012).

Computer-assisted learning has its roots in cognitive architecture that allows for learning to take place (Greer et al., 2013; Hollender, Hoffman, Deneke, & Schmitz, 2010). Online learning can spread the cognitive load between dual processing channels by presenting important content using two modes, visual and auditory (Hollender et al., 2010). Applying the CLT to computer-assisted learning requires that the cognitive load of the learning task is appropriate to the individual needs of the learner (Darabi & Jin,

2013). Analyzing computer-assisted interventions for remediation purposes is essential to the success of students using this mode of intervention.

Researchers dedicated to applying the CLT to the field of education understand how the use of text and pictures improves learning, relative to the use of text alone (Ayers & Paas, 2012). Wong, Leahy, Marcus, and Sweller (2012) investigated whether computer-assisted instructional programs incidentally provided transient information that overwhelmed the WM learners and interfered with their ability to learn new information. The researchers found that the audio and visual animations used in the computer programs to remediate learning were distracting and tended to overload the WM capacity of the learner. Many of the study participants were not able to learn new information because the animations and audio-visuals not related to the learning task were distracting and negatively affected the learning objective of the computer program. The researchers found that if transient information is not properly controlled it could negatively affect the learning intentions of an instructional intervention (Wong et al., 2012). Researchers have found that developing high-quality animations requires control factors such as cueing, segmentation, learner control, and saliency (Ayers & Paas, 2012). Being aware of the influences of instructional designs can allow designers to produce quality animations that do not strain the WM capacity of learners.

Computer-assisted instructional interventions have the potential to minimize the academic achievement gaps of students with specific deficits or worsen them if cognitive load is not taken into consideration with the intervention being used for remediation (Greer, Crutchfield, & Woods, 2013). Care has to be taken when determining computer-

assisted interventions because some programs are designed in ways that overwhelm the WM capacity of learners and thus negatively affect learning (Wong et al., 2012). Computer-assisted interventions that do not account for the limitations of the WM nor strive to change the long-term memory of learners will likely be ineffective.

My study will provide educators with further insights regarding effective interventions to help improve the reading comprehension skills of students with LD in reading. The CLT is a learning theory created to help educators focus on how students learn and how to use instructional materials to be advantageous for students struggling with deficits. According to Chandler and Sweller (1996), instruction must be tailored to the needs of the learner to be efficient and not overload their WM capacities. Use of the CLT has paved the way to more useful and effective instructional designs and procedures (Paas, van Gog, & Sweller, 2010). The CLT offers a basis for educators to create individualized instruction, which is crucial for students in a classroom environment with varying levels of aptitude.

Learning Disabilities and Reading Interventions

Comprehension is the goal of reading; therefore, students who struggle with reading may lack a genuine understanding of the written language (Lenhard, Baier, Endlich, Schneider, & Hoffman, 2013). Research has consistently shown that despite maintaining adequate levels of reading accuracy and fluency, approximately 10 to 15 % of children experience poor reading comprehension (Spencer, Quinn, & Wagner, 2014). Data from national studies on the reading achievements of students with disabilities in reading have consistently resulted in low growth rates for students with disabilities

despite receiving interventions (Vaughn & Wanzek, 2014). Researchers concerned with improving reading skills often suggest that interventions directly targeting comprehension are most helpful for students beyond the elementary level (Lenhard et al., 2013). School administrators are responsible for providing all students with the opportunity for an education however it is necessary for teachers to provide students with effective interventions to ensure all students are learning to their highest potential (Moreau, 2014). Students with LD in reading must be taught using interventions tailored to their specific learning needs. The following literature review will explore learning disabilities, content area reading interventions, direct instruction interventions, computer-assisted interventions, and the role teachers have in providing interventions to provide a rationale for this study as well as provide approaches to the problem by other researchers highlighting strengths and limitations. The literature review will also provide a summary of the independent variable - type of reading intervention, and the dependent variable - Scholastic Reading Inventory (SRI), of the study.

Learning Disability

In the United States LD is essentially a category for reading failure (Hassan, 2015). Samuel Kirk coined the term *learning disabilities* in the early 1960s to describe a group of students with developmental disorders in language, speech, reading, and other communication skills needed for socialization (Buttner & Shamir, 2011). In 1968 LD was recognized in the United States as a special education condition that represented students who were not learning despite their general intellectual competency and ample learning opportunities (Hassan, 2015; Moats & Lyon, 1993). Historically, students

categorized as LD were marginalized because their cognitive and educational characteristics were different from the other established disability categories and educators were not confident on how to approach their unique deficits (Hassan, 2015). Today, students identified as LD are categorized based on their performances in the areas of reading, writing, or oral language and receive educational services based on their deficits in those areas (Sleeter, 2010). LD is an individualized disability and researchers often state it is caused by a central nervous system dysfunction making it challenging for educators to find an effective and all-inclusive intervention (Ashkenzi, Black, Abrams, Hoeft, & Menon, 2013). Since students with LD in reading do not make up a homogenous group, it is essential that educators provide different types of interventions to meet their individual needs and reach their goals.

Reading Interventions

Reading comprehension is critical for students and to properly acquire comprehension skills students have to be able to apply reading strategies to fully benefit from the reading (Lan, Lo, & Hsu, 2014). When students with LD in reading are provided with the appropriate strategies and instruction, they learn to comprehend text adequately (Jitendra & Gajria, 2011). Students are expected to read at proficient levels with adequate vocabulary and comprehension skills when they enter middle school. In the United States about 30% of middle school students with reading-related LD require specific, intensive, and explicit reading instruction either individually or in small groups to meet grade level standards (Moreau, 2014). Sustained intervention and support has been determined by researchers to be principal to the success of struggling readers

especially those with reading disabilities (Vaughn & Wanzek, 2014). Older students with reading deficits benefit from reading instruction that fosters background knowledge, vocabulary development, ability to detect and comprehend relationships among concepts, and the ability to use strategies to ensure understanding and retention of reading material (Swanson, Wanzek, Vaughn, Roberts, & Fall, 2015).

Content Area Reading Instruction Intervention

Content area reading interventions have been explored as viable strategies to improve the reading comprehension skills of students at the middle school level who struggle with reading. In middle and high school, reading instruction shifts from foundational skills to more complex skills requiring students to rely on their comprehension abilities to gain an adequate understanding of text (Yakimowski, Fagella-Luby, Kim, & Wei, 2016). The concern with the shift in reading instruction and expectations is for the students with LD who struggle with reading comprehension. In most schools across the United States, students with LD receiving instruction in the general education classroom are expected to make the same academic progress as their peers without disabilities in reading making the need for reading comprehension across curriculums dire for students with LD in reading (Kaldenberg, Watt, & Therrien, 2015). Fostering reading comprehension skills across the curriculum provides students with LD in reading multiple chances to learn and practice meaningful skills to improve their comprehension and ability to create better opportunities for themselves.

Reading researchers concerned with improving the reading comprehension skills of students struggling with reading have implemented studies evaluating the effectiveness

of the content area reading instruction intervention. Researchers often opt to investigate the content area reading intervention in social studies and science classrooms because they involve the use of densely packed text that is often written beyond the grade level reading comprehension (O'Connor, Beach, Sanchez, Bocian, & Flynn, 2015). The content area reading instruction intervention can easily be integrated into the curriculum to help build the limited reading comprehension skills of struggling readers. Swanson et al., (2015), conducted studies that incorporated comprehension strategies within the social studies classroom with positive results. Kaldenberg et al. (2015) concluded that content area reading instruction in the science classroom is beneficial to students with LD in reading. The implementation of the content area reading instruction intervention supports the CLT, which the study is based on because it emphasizes the systematic use of interventions within the classroom to teach complex skills (Gredler, 2012). The content area reading intervention is an effective strategy that rarely happens in a typical classroom setting (Yakimowski, Faggela-Luby, Kim, & Wei, 2016). The rationale for content area teachers not implementing the interventions could be because many teachers are not as confident in their abilities to teach reading or they do not want to dedicate their instructional time to teaching a basic skill (O'Connor et al., 2015). Although the content area reading strategy is rarely implemented, the following studies demonstrate how effective the intervention is when implemented within a social studies classroom.

A longitudinal study by Swanson et al. (2015) investigated the reading comprehension skills of students with disabilities in a middle school social studies classroom. The investigators tracked the results of a direct instruction curriculum named

Promoting Acceleration of Comprehension and Content Through Text (PACT) and found that students who were in the treatment group outperformed those in the comparison group on knowledge acquisition and reading comprehension. O'Connor et al., (2015) also conducted a reading comprehension study implementing a direct instruction intervention named Building Reading Interventions Designed for General Education Specialists (BRIDGES). The BRIDGES curriculum is a content-area reading intervention. The researchers implemented the study in a history class to help student participants improve their academic vocabulary and help them identify cause and effect relationships. Overall, students who participated in the BRIDGES intervention showed more growth than the comparison group in academic vocabulary and cause and effect relationships (O'Connor, et al., 2015). These studies demonstrated how implementing simple intervention strategies positively affect the reading comprehension skills of students with LD in reading.

Direct Instruction and Computer-Assisted Interventions

Direct instruction. For students with reading disabilities, sustained interventions and support may be vital to their success (Vaughn & Wanzek, 2014). Reading interventions must be tailored to accommodate the individual needs of students. The use of direct instruction (DI) has long been used to address the needs of struggling readers. Siegfried Engelmann developed DI in 1964. His program consisted of highly structured reading programs that required the instructor to teach students lessons systematically and explicitly through modeling and guided practice. Engelmann also required instructors to assess student-learning outcomes during independent and guided practice (Stockard,

2010). DI is founded on three cognitive learning analyses: behavior, communication, and knowledge systems (Binder & Watkins, 2013). DI is a teacher-directed approach to learning. The DI model was initially designed to help remediate 'at risk' populations at the preschool level however it has since expanded to include multiple ages and grade levels of students and various subject areas (Stockard & Engelmann, 2010). Teachers because of its detailed scripting of teacher lessons often resist DI. Despite resistance, DI has consistently resulted in greater academic achievement and problem-solving abilities of children than any other traditional teaching approach when implemented properly (Binder & Watkins, 2013).

Computer-assisted interventions. At the middle school level providing appropriate intensive interventions can be challenging to implement therefore teachers must have intervention options available to utilize such as computer-assisted interventions. Technology has introduced a myriad of possibilities for remediation of reading difficulties. Computer-assisted reading interventions assist teachers by providing individualized and targeted support to provide remediation in areas of difficulty. Computers allow text and remediation material to be presented in an attractive manner to attract learners through the use of animation and immediate feedback. Computer programs designed for remediation scaffold and support memory and attention processes that are central to learning (Falth, Gustafson, Tjus, Heimann, & Svensson, 2013). Computer-assisted interventions targeting reading comprehension can be an effective reading intervention alternative (Falth et al., 2013). The CLT aligns with the use of computer-assisted instruction because they allow students with short-term memory and

attention deficits to develop their basic reading skills in a way that does not overwhelm their cognitive processing.

Technology assists teachers with incorporating remediation efforts within their classrooms. Computers are adaptable to the individual learning needs of students by assessing their knowledge and building lessons to fill in learning gaps (Cheung & Slavin, 2013). Effective interventions can decrease the gap between typical readers and students with reading difficulties if they are using well-planned and systematic interventions (Falth et al., 2013). According to researchers computer-assisted or electronic interventions are best practices to use in today's modern classroom because they can individualize student learning and support differentiation opportunities. Computer-assisted interventions provide teachers with access to current data as well as allow for the individualization of activities/lessons to support the learning needs of all students within one learning environment (Roskos & Neuman, 2014). Incorporating computer-assisted reading interventions allows teachers to make informed decisions about reading strategies to implement for students within a classroom.

Researchers have conducted experiments determining that DI and computer-assisted instruction are effective methods to help improve the reading comprehension skills of students with LD. Researchers have conducted countless studies on the effectiveness of DI reading programs for struggling readers, which included programs like Great Leaps and Reading Excellence Word Attack and Rate Development Strategies (REWARDS) (Spencer & Mantis, 2010; Graves, Brandon, Duesbery, McIntosh, & Pyle, 2011). Other successful reading programs utilized computer-assistance to help improve

the reading comprehension scores of students as demonstrated by Gibson, Cartledge, and Keyes (2011) who investigated the effectiveness of the Read Naturally software program. Findings from the Read Naturally program supported the use of computer-assisted software to be a supplemental program to help improve the comprehension skills of struggling students (Gibson, Cartledge, & Keyes, 2011). Researchers utilizing DI, computer-assisted instruction, and a combination of both will be analyzed to demonstrate how traditional DI, commercialized DI, and computer-assisted programs help students improve reading comprehension skills. Studies involving the use of multiple DI and computer-assisted interventions to improve the reading comprehension skills of students with LD will also be examined. The chosen studies will not only help fill a gap in the literature on reading comprehension but also support the assertion that students should be placed in interventions based on their individual achievement level and older students with low skills should receive intensive DI that builds background knowledge and the understanding of content learning.

The explicit teaching of basic skills may be necessary when helping students with LD in reading achieve reading comprehension success. DI can provide the level of intensive remediation struggling students at the middle school level may need. Solis, Miciak, Vaughn, and Fletcher (2014) conducted a longitudinal study with participants throughout their middle school years to determine the effectiveness of teacher-led DI in the areas of fluency, vocabulary, and reading comprehension. Solis and colleagues (2014) analyzed TAKS reading scores and determined participants in the intervention

group surpassed the comparison group adding confirmation that DI is a viable reading intervention strategy.

Although DI is effective when addressing the needs of struggling readers, investigators may opt for computer-assistive programs to assist them with this sometimes arduous task. The researchers Parker, Holland, and Jones (2013) conducted an intervention study that utilized two computer-assistive programs, Voyagers Journey III and Read 180 to determine which program was most effective at improving the reading comprehension skills of middle school students. The researchers found after implementing an ANCOVA analysis of SRI pretest and posttest scores, the Voyagers Journey III provided a statistically significant gain based on Lexile scores. Parker, Holland, and Jones, (2013) demonstrated how computer-assistive programs improved students reading skills, however other researchers prefer to use a combination of computer-assistive programs and DI. Proctor, Daley, Loick, Leider, and Gardner (2014) implemented a reading comprehension intervention for students with LD in reading by employing both the computer-assistive program Read 180 along with DI provided by ELA teachers. The researchers used ANOVA to analysis the SRI pretest and posttest scores of student participants and discovered that students receiving both reading interventions significantly exceeded the study comparison group. Lenhard, Baier, Endlicher, Schnieder, and Hoffman (2013) also utilized computer-assisted interventions and DI approaches. The computer-assisted intervention conText, was compared to the DI intervention, Reading Detectives. The researchers randomly assigned students to groups and the interventions were embedded into the ELA curriculum. After analyzing pretest

and posttest data using ANCOVA, the computer-assisted intervention group showed the greatest improvement in reading comprehension skills. Researchers dedicated to improving reading comprehension for students with LD in reading at the middle school level have demonstrated with the appropriate interventions, students can improve their skills. DI interventions as well as computer-assisted interventions can be vital to improving the reading skills of students with LD struggling with reading comprehension.

Compass Learning Intervention

Teachers can implement computer technology to create new learning environments that allow for more personalization and richer learning opportunities for students. Computer-assisted instruction serves as a practical solution for teachers to help struggling readers when the option of other strategies such as one-on-one instruction is not feasible. Compass Learning is a computer-assisted integrated learning system that provides students with individualized instructional sequences based on extensive assessment sets (Cheung & Slavin, 2013). The Compass Learning program assesses student current learning then develops an individualized instructional sequence to remediate missing skills and develop newly acquired skills (Cheung & Slavin, 2013). The Compass Learning program along with other computer-assisted instruction programs adapts to student needs by building on their initial knowledge and providing instructional remediation that fills in their achievement gaps (Cheung & Slavin, 2013). The Compass Learning program is being used in the study as a reading comprehension intervention to help remediate reading skills. A study by Cobb (2010) demonstrated how effectively

implementing the Compass Learning computer-assisted software program could help struggling readers.

Cobb (2010) conducted a study with teachers who implemented the Compass Learning computer-assisted software program with their students who were struggling readers. The teachers completed surveys during the winter and spring semesters to self-report their use of the computer-assisted program. After implementing the Compass Learning intervention, the teachers increased their use of technology in their classrooms by 2.6% and reported their levels of comfort with the Compass Learning program to address their struggling readers comprehension deficits was moderate to high. As a result of the intervention, both teacher technology usage and student reading skills increased.

Scientific Research Associates (SRA)

One scientific, research-based reading intervention program that has been successfully implemented to improve reading skills is the Scientific Research Associates (SRA) Corrective Reading program. The SRA Corrective Reading program was designed by Siegfried Engelmann to be used as a DI teaching model (Engelmann, Hanner, & Johnson, 1999). The SRA DI model provides specific direction for decoding; verbal reading exercises with immediate feedback; and frequent accuracy checks (Steventon & Fredrick, 2003). The explicitly taught strategies with the SRA Corrective Reading could help improve the reading comprehension skills of older struggling readers.

Corrective reading programs such as SRA have improved the reading outcomes of struggling readers employing DI strategies. Lykken, Wakeman, McLaughlin, and Zumwatt (2014) implemented the SRA to help improve the decoding, comprehension,

and fluency of an older student with LD struggling with reading. The researchers results indicated an improvement in the reading comprehension skills of the research participant, improving from a baseline of 0% to 72% by the end of the intervention period. Comparatively, Shippen, Houchins, Steventon, and Sartor (2005) implemented a corrective reading intervention utilizing either the Corrective Reading DI program or the Reading Excellence Word Attack and Rate Development Strategies (REWARDS) DI program. The researchers discovered regardless of the corrective reading program, students demonstrated improvements in their reading comprehension. Generally, researchers incorporating DI strategies have successfully assisted students with LD in reading remediate their skills.

Teacher Implementation of Interventions

In efforts to improve the reading comprehension skills of struggling students, many school officials turn to school reform initiatives that require teachers to implement interventions targeted at improving specific skills. Although these initiatives are put in place at many schools throughout the United States, researchers have shown that an overwhelming amount of teachers at the middle and high school level are reluctant to implement the reading interventions. Researchers found that teachers who were reluctant to carry out reading interventions either did not feel responsible for teaching reading or they felt ill prepared to teach reading to struggling students (Cantrell, Almasi, Carter, & Rintamaa, 2013). Educational researchers in the area of reading have shown that teachers implementing reading interventions who have a strong negative belief about their ability to affect student learning often implement interventions lacking fidelity, which may lead

to possible negative program outcomes (Cantrell et al., 2013). Understanding the importance of intervention implementation fidelity and teacher efficacy can be powerful steps towards improving the reading comprehension skills of struggling readers through the use of reading interventions. The teachers at the research school were not formally assessed to determine their levels of implementation fidelity for the interventions they implemented for struggling readers therefore, results from the intervention efforts may not be true representations of the intervention effectiveness. The following research studies provide evidence that teacher implementation fidelity strongly influences the outcomes of an intervention.

The importance of teacher efficacy and their implementation of strategy-based reading interventions were established by Cantrell, Almasi, Carter, and Rintamaa (2013). The researchers investigated the extent to which teachers implemented a reading related intervention named Learning Strategies Curriculum. Researchers learned that all teachers implemented the intervention during class time at least 50% of the time. Teachers who demonstrated high levels of personal efficacy were more likely to be motivated to implement the intervention at higher rates nearing 100% (Cantrell et al., 2013). Fogarty, Oslund, Simmons, Davis, Simmons, Anderson, Clemens, and Roberts (2014) also conducted a research study investigating the level of teacher implementation of a reading comprehension intervention named Comprehension Circuit Training (CCT), a curriculum with a goal of remediating the reading skills of students who struggled with reading. Overall, researchers found that as teacher fidelity of implementation increased student reading outcomes improved. A study by Benner, Nelson, Stage, and Ralston (2011)

further explored teacher implementation of interventions by focusing on two components, adherence and quality of instruction. Benner et al. (2011) were investigating if adherence and quality of instruction improved or inhibited student reading intervention outcomes. After implementing the Corrective Reading intervention, student scores and fidelity observation checklists were analyzed. In the final analysis, researchers determined that fidelity of implementation accounted for 22% of the variance in the gains in basic reading skills and 18% of the passage comprehension gains, making the results statistically significant. The results from Cantrell et al. (2013), Benner et al. (2011), and Fogarty et al. (2014) infer the need for teachers to have a high degree of implementation fidelity to reap successful student outcomes.

Teacher Perceptions of Technology Integration

The introduction of the No Child Left Behind (NCLB) Act Title II, Part D charged school officials with improving education through the use of technology, while increasing the level of accountability schools had in student performance outcomes. As a result of federal regulations, many school officials emphasized and required the use of initiatives and interventions that required the use of technology in the classroom (Bishop, Holland, & Jones, 2015). In many of today's classrooms teachers are seamlessly implementing interventions to improve student outcomes with the help of technology, however some teachers are resistant to technological integration. Researchers concerned with technology integration at the classroom level have found that teacher perceptions and beliefs determine their level of effectiveness when implementing technological interventions (Chikasanda, Otrel-Cass, Williams, & Jones, 2013). Teacher perceptions of

technology can either enhance or constrain student outcomes when implementing technology-based interventions therefore it is important to investigate barriers to technological integration that could affect intervention outcomes. The researchers in the following section implemented interventions to determine how teacher perceptions about implementing computer assisted interventions affected student outcomes.

The beliefs teachers possess about learning and the implementation of technology influences their level of technology integration and possibly the outcomes of an intervention. Kim et al., (2013) explored the areas of epistemology, conceptions of teaching, and technology integration to help create a comprehensive understanding of teacher perceptions in education. The researchers found a significant correlation between teachers' beliefs about the nature of knowledge and their beliefs about the ways of teaching. Kim and colleagues (2013) determined, overall the more refined the teachers' nature of knowledge and learning, the more likely they were to successfully integrate technology in the classroom. Although the findings from Kim et al (2013) were positive, not all instances of technology integration in the classroom produce positive results. Kuyatt, Holland, and Jones (2015) investigated if there was a difference in student performance on statewide achievement measures as a result of high-level technology integration. The teachers in the study integrated varying degrees of technology in their classrooms prior to end of the year statewide testing. The ANOVA results of achievement data were significant and it was determined that higher test score proficiency was positively correlated with teachers who implemented high levels of technology in their classrooms. Students who scored in the non-proficient range did have

technology integrated within their classrooms however the levels of implementation were not high or implemented with high levels of fidelity (Kuyatt, Holland, & Jones, 2015). The research studies demonstrated the importance of teacher perceptions as they relate to technology integration in the classroom. It can be inferred that just implementing technology does not solicit change. These studies further support the idea that implementation fidelity is a critical factor when examining correlations between student achievement and technology based interventions and assessments.

Teacher Motivation for Implementing Interventions

Teacher motivation is fundamental to ensuring an intervention is implemented correctly and with fidelity. Teachers' perceptions can assist or hinder the implementation of effective teaching practices. Researchers have shown that highly motivated teachers incorporate motivating strategies to encourage students and provide scaffolds to motivate them to take risks. Many teachers perceive motivation by students as a desire or a drive to engage in an activity that can be internal or external. Although many teachers believe motivation is found within the student, researchers have determined that teacher motivation can positively influence student motivation (Taboada & Buehl, 2012). Researchers have explored teacher beliefs in various contexts however many have not explored teacher beliefs in terms of reading comprehension and motivation to read (Taboada & Buehl, 2012). The research studies in the following section adds sustenance to the study and theories that support understanding teachers perceptions on concepts such as reading comprehension and motivation, in order for school officials to develop their knowledge and target misconceptions in their thinking.

Taboada and Buehl (2012) conducted a qualitative research study that helped reinforce theories supporting the need to understand teacher perceptions regarding concepts such as reading comprehension and motivation as a way to target misconceptions about teaching and student learning. Taboada and Buehl (2012) examined the reading comprehension beliefs of teachers from the United States and Argentina by investigating how reading comprehension was regarded and how it was supported between teachers from the United States and teachers from Argentina. Generally, teachers from the United States believed reading comprehension was developed using both external and internal student motivation. Conversely, teachers from Argentina believed student reading comprehension was externally motivated. Teachers from the United States often employed DI reading strategies to teach reading comprehension and teachers from Argentina often employed strategies that exposed students to a wide variety of text and engaging in in-depth thinking activities. When researchers inquired about how teachers motivated students, they all agreed giving students choice in their reading materials helped facilitate an increase in student motivation to read. Gorozidis and Papaioannou (2014) conducted a similar study; the researchers were investigating if teacher motivation correlated with their intentions of implementing interventions within their classrooms. Gorozidiz and Papaioannou (2014) utilized a mixed methods research design. The teacher participants were responsible for implementing a new subject named Research Project as their intervention. Results for the data analysis revealed that teachers who had high autonomous motivation to implement the intervention had high positive outlooks related to their jobs and themselves such as

job satisfaction, increased sense of personal accomplishment, and increased students' independent motivation to learn. The data also revealed that teachers' willingness to participate in the intervention was due to intrinsic motivation (Gorozidis & Papaioannou, 2014). The preceding studies provided evidence that teacher motivation to implement an intervention is essential to intervention success. The studies further provided evidence that trainings and professional development should include ways to build teachers intrinsic motivation to ensure they are willing to implement interventions with high fidelity.

The Role of Teacher Support for Intervention Implementation

Teachers are often expected to implement interventions without much preparation or support. Researchers have found that many interventions fail because teacher beliefs, practices, and values were not considered when initiating interventions. Supporting teachers is imperative when implementing new programs and sustaining those already in place. Traditional in-service professional development providing teachers' support with strategies such as coaching can unequivocally effect intervention efforts. The study will analyze findings from interventions implemented by other teachers that were not highly supported during the implementation process.

To address how important teacher support is when implementing interventions, Reinke, Stormont, Herman, and Newcomer (2014) investigated an association between ongoing coaching support activities and teacher implementation of a classroom management intervention. After completion of the two-way ANOVA repeated measures analysis of covariance (ANCOVA) it was determined by Reinke and colleagues that over

time, teachers who implemented the classroom management intervention had fewer instances of reprimand and increased levels of student praise. The interaction between the amount of teacher performance feedback and their implementation of the proactive classroom management skills was statistically significant. The study results also revealed that the more coaching support teachers received throughout the intervention, the better their implementation skills were. Teachers who had initial high levels of implementation decreased over time with less coaching support. Comparatively, Patore, O'Brien, Jimenez, Salianas, and Ly (2016) conducted a research study investigating the effects of technology integration for preservice teachers taking a literacy course on integrating educational media in the classroom. Teacher participants committed to utilizing technology during their literacy instruction during the upcoming school year. Qualitative data results of the teacher participants revealed greater technology integration knowledge, increased content knowledge, and a significant increase in their perceptions of developing their professionalism in the areas of technology integration and teaching. Quantitative data results revealed the most common technology integration in class was used for publishing, presenting, customizing media, and/or video. The previous studies provided evidence that being properly trained and supported while implementing technology interventions can effectively affect student outcomes. The teachers from the study site were required to implement a technology-based intervention however they did not receiving ongoing support. The lack of support may have negatively affected the results of the reading interventions implemented by teachers at the research school.

Summary and Conclusions

The Institute for Education Science, National Center on Special Education Research recognized the need to address the instructional deficits of student with LD in the area of reading through the use of intensive interventions by calling for proposals to enhance the knowledge base (Vaughn & Wanzek, 2014). Researchers have found that students with LD benefit from multiple interventions varying in levels of intensity based on their individual needs (Graves et al., 2011). However, it is not known to what extent multiple interventions differ from individual interventions with respect to reading comprehension levels. This research study helped fill in a gap in practice by providing further insights into what extent intervention strategies increased the reading deficits of students with LD through the use of direct instruction and computer-assisted interventions. Chapter 3 includes information on the research design, rationale, methodology, threats to validity, and ethical procedures followed for conducting this research study.

Chapter 3: Research Methods

Introduction

The purpose of this quantitative, ex-post facto quasi-experimental study was to (a) determine the extent that reading intervention strategies were meeting the intended goals of increasing the reading achievement scores of students with LD in reading, and (b) determine if there was a difference in reading achievement scores for the two reading intervention groups from pretest to posttest. Students with LD in reading may not be able to read at proficient levels, which can negatively influence their performance in all content areas, making it vital that adequate reading interventions are in place (Hassan, 2015; Lan, Lo, & Hsu, 2014). Computer-assisted interventions and direct instruction interventions are methods for narrowing the achievement gap for students with LD and others who struggle with reading (Lenhard et al., 2013). Findings from my study may aid school leaders in determining how to best use resources with a goal of increasing reading scores for struggling readers. The achievement score data I analyzed in this study provided needed insight to determine the extent that different intervention strategies contributed to the reading comprehension scores for students struggling with reading comprehension as a result of their LD.

To answer Research Question 1, I examined the extent to which different reading intervention strategies influenced the reading achievement scores of seventh grade students with LD in reading as defined by SRI reading achievement scores. To answer Research Questions 2 and 3, I determined there was a difference in student reading scores from pretest to posttest for each of the two reading intervention groups for students with

LD. The test scores that were compared in this study were from (a) students who participated in the dual interventions Compass Learning and SRA corrective reading intervention, and (b) students who participated in a single intervention, Compass Learning reading intervention. To examine the extent that the reading intervention strategies influenced the reading achievement scores, I used a quasi-experimental research design and analyzed the data with one-way analysis of variance (ANOVA). Additionally, I analyzed the reading scores of students from Group A and Group B to determine if there was a difference between the students' reading achievement scores from pretest to posttest as measured by the SRI reading assessment.

In this chapter, I discuss the quantitative research design and my rationale for the design choice. I also include discussions of the research population, the sampling procedures I used to determine the research sample, and the data collection procedures that I employed to collect archived data. I also discuss the instrumentation, threats to validity, and ethical procedures to ensure participant rights were protected.

Research Design and Rationale

I used a quantitative, quasi-experimental design for this research study because it would have been unethical and unfeasible to create a true experimental group. The quasi-experimental design is an approach researchers use to compare existing groups (Yurt & Tunkler, 2016). The ex-post facto research design is an approach used after an intervention has been implemented (Kerlinger, 1986). I used the quasi-experimental, ex-post facto research design for this study because it was composed of pre-existing groups that were not randomly assigned, and because the data I analyzed were archived student

data. The students at the research school were grouped in their intervention groups based on a common characteristic, which was their reading achievement level. The data from the students used in this research study were from archived reading achievement score data that were collected during the 2014-2015 school year. The school district administrators along with the research school administrators determined the reading achievement levels of students by using the SRI reading assessment. Every year students across the school district are expected to read at a certain level for promotion to the next grade level; during the 2014-2015 school year, the expectation for seventh grade promotion was a score of 855 on the SRI assessment. The students in the intervention groups did not meet the promotional reading level requirement and had scores of 854 and below (see Shannag, Tairab, Dodeen, & Abdel-Fattah, 2013). The statistical test that I performed showed significant differences from pretest to posttest between the two intervention groups. The test results indicated the reading interventions provided significant changes in the reading levels of students with LD in reading.

The data that I analyzed were aggregated student data that came from the fall 2014 SRI testing session, the winter 2015 testing session, and the spring 2015 SRI testing session of seventh grade students with LD in reading at the research school. Students were given a reading comprehension assessment fall 2014 to establish a baseline; this served as the pretest data. Once student data were received, teachers divided the students into two different intervention groups based on their reading achievement levels. Students who scored within 100 points of the 855 promotional score (754-854) were placed in the computer assisted reading intervention group. Students who scored more

than 100 points away from the promotional score (753 and below) were placed in the computer assisted and direct instruction reading intervention group. Special education teachers implemented direct instruction using the SRA corrective reading intervention. The SRA corrective reading intervention was provided weekly to students with teachers completing progress monitoring. Special education teachers and language arts teachers implemented the computer assisted reading intervention, Compass Learning, each week. During the winter of 2014, students took the SRI, which was a midpoint reading assessment to monitor progress. In spring 2015 students took the SRI posttest assessment. I analyzed the SRI pretest (fall) and posttest (spring) reading assessment data.

Ex-post facto research design is a non-experimental research design that researchers use to analyze data after it has occurred (Cohen, Manion, & Morison, 2000). The ex-post facto research design allowed me to analyze previously collected reading achievement data from students and retrospectively examined the variables that brought about a difference between the two groups. The ex-post facto research design also helped me determine there was an influence of one variable on another variable (see Simon & Goes, 2013). In this study, I examined differences for two groups of students who were in non-random, preexisting groups and participated in reading interventions to increase their reading comprehension scores.

Methodology

Population

The population in this study came from middle school students with LD in reading from a suburban school located in the southeastern United States. The school consisted of sixth through eighth grades with a total school population of over 1,000 students during the 2014-2015 academic school year. During the 2014-2015 academic school year, there were 70 certified educators at the school during the research timeframe with 100% of the core content teachers reading endorsed. I limited the study to the scores of seventh grade students who received special education services for LD in reading and received their instruction in an inclusion classroom setting with both a general education teacher and a special education teacher. The target sample size was from seventh-grade students who had reading achievement scores ranging from 0 (beginning reader) to 1386 (career ready expectations). The sample consisted of 46 students out of an approximate population of 60; the sample size was chosen according to the G-Power statistical power analysis program in order to perform an ANOVA analysis.

Sampling and Sampling Procedures

The sampling frame for this research study were seventh grade students with LD in reading who received their special education services in an inclusion classroom setting. I used a convenience sampling method. The resultant convenience sample consisted of two intact groups: (a) students who received a single reading intervention, Compass Learning, which is a computer-assisted reading intervention; and (b) students who received dual reading interventions, Compass Learning (computer-assisted) and SRA

(direct instruction) reading intervention. The site administrators established the two intervention groups during the 2014-2015 school year. The SRI reading assessment scores on the SRI range from beginning reader (BR - 0) to college and career ready expectations (1386 and above; SRI, 2014). The score expectation on the SRI for all students in the seventh grade was at least 855, which was the basic level for reading at the seventh grade level and the promotional requirement score for the research school. For the intervention groups, students with scores that were within 100 points of the promotional requirement (854-754) were placed in Group A (the single-intervention group). Students with scores that were more than 100 points from the promotional requirement (753 and below) were placed in Group B (the dual-intervention group).

A total of 63 seventh grade students received special education services for LD in reading. To determine the needed sample size for this research study, I used G-Power software for Mac. A one-way ANOVA, A priori power analysis using a large effect (0.60), an alpha level set to 0.05, and power of 0.95 indicated that a minimum of 40 student scores were needed for the comparison groups (see Buchner et al., 2009). The confidence interval describes the amount of uncertainty associated with the sample population estimate (Lodico, Spaulding, & Voegtle, 2010). The confidence interval for this study was set at 95% to account for the differences between the two groups (Laerd Statistics, 2013).

Procedures for Participation and Data Collection

All student reading achievement scores used in this study came from seventh grade students who had LD in reading and received their special education services in an

inclusion classroom setting. An administrator at the research school site provided me a list of the reading achievement scores of the seventh grade students with LD in reading for the 2014-2015 academic school year. An administrator provided the reading achievement scores number coded using only the last four numbers of the students' identification code to protect the identity of the students. I retrieved this data from the administrator after receiving approval to conduct research from Walden University's Institutional Review Board (IRB) along with permission to access the data from the school district's Office of Accountability, Assessment, and Reporting.

Instrumentation and Operationalization of Constructs

I used the SRI reading assessment to measure the archived reading level data. Students participated in two types of reading intervention strategies based on their reading level data. Regardless of the type of reading intervention strategy students participated in, their reading levels were measured by the SRI reading level assessment. The students initially took the SRI reading assessment during fall 2014 to establish pretest and baseline data. The fall SRI reading level was also used to establish the reading intervention groups. Students who did not score a minimum of 855 on the fall 2014 assessment were divided into reading intervention groups based on their individual reading level scores. Students who scored between 854-754 were placed in a reading intervention group that participated in a single reading intervention, Compass Learning (computer-assisted). Students who scored 753 and below were placed in a reading intervention group that participated in dual reading interventions, Compass Learning (computer-assisted) and SRA (direct instruction).

Instrumentation. The school district where the research school was located started an initiative beginning in 2010 to improve student literacy. School district leaders implemented the use of the SRI reading assessment in all district wide elementary and middle schools to determine individual student reading ability and implemented district wide interventions to help improve the reading skills of struggling readers. The SRI reading assessment was first developed in 1998 as a print-based test of reading comprehension. In late 1998, a computer version of the test was developed. Subsequent versions of the test were launched between 1999 and 2006 (Scholastic, 2014). The SRI computer based reading assessment is based on the Lexile framework for reading, a reading comprehension program that primarily focuses on reader ability and text complexity. The Lexile scale was developed on the Rasch item-response theory model to estimate the difficulties of items and the abilities of readers (Scholastic, 2014). The SRI testing instrument is a reliable and valid testing instrument that has been used to assess reading achievement levels by the school district for seven years.

The SRI reading assessment scores indicated the reading level ability of students taking the test. The reading level scores from the assessment range from beginning reader (BR – 0) to career ready expectations (1386 and above). The test scores were used by the research school to determine students' reading abilities and provide interventions to students who were identified as struggling readers as a result of the SRI assessment. The 855 promotional requirement set by the school district was the minimum score needed to be considered reading at a basic level. The school administrators at the research school determined the promotional requirement put in place by the school

district was the minimum requirement score at the school level used to place students into intervention groups.

The school administrators intended to increase the reading scores of all students therefore they developed reading intervention groups that varied in complexity to ensure all levels of struggling readers were receiving remediation. Based on the fall 2014 SRI assessment scores, if students scored within 100 points of the 855 promotional requirement score (854-754) they were placed in reading intervention groups that participated in the computer-assisted reading intervention only. If students scored more than 100 points away from 855 (753 – 0) they would receive more intense reading remediation. Students scoring below 753 were placed in reading intervention groups who received a computer-assisted reading intervention in addition to a direct instruction intervention. To monitor progress of the reading intervention programs, students took the SRI reading assessment in the winter of 2014, which was midway through the school year to monitor student progress. Students remained in their reading intervention groups the entire academic year regardless of their score midyear.

Reliability. SRI reading assessment creators determined content-sampling error by applying an internal consistency reliability coefficient for Foundational Reading Assessment scores. The reliability analysis indicated that the Foundational Reading Assessment scores of total fluency, reading fluency, and word-level reading fluency without letters met the highest standards of reliability with a standard error of measurement ranging from 2 to 4, which corresponds to a 95% confidence interval (Scholastic, 2014).

Validity. SRI reading assessment creators provided test validity through content validity, criterion-related validity, and construct validity. Content validity of the SRI reading assessment was built into the Reading Comprehension Assessment when the program was being developed. The test items had Lexile measures between 200 and 1000 (Scholastic, 2014). The criterion-related validity of the Reading Comprehension Assessment was tested for effectiveness in predicting the individual behavior of students in specific situations. The SRI reading assessment was tested for criterion-related validity using the Read 180 reading intervention program. Researchers found that each of the sample studies given to middle school students receiving special education services revealed that the Read 180 reading intervention program was positive and students made significant gains according to the SRI reading assessment (Scholastic, 2014). The construct validity of the Reading Comprehension Assessment portion of the SRI reading assessment was determined by examining the correlations between a new test and the Reading Comprehension Assessment. Researchers found the results of the assessments had a moderate to high correlation that suggested the assessments were measuring similar constructs making the Reading Comprehension Assessment valid (Scholastic, 2014).

Independent and Dependent Variables. The independent variable (IV) in this research study was the type of reading intervention received by students. To answer Research Question 1, the IV included both reading intervention types (single intervention vs. dual intervention) and the dependent variable (DV) was the students' end of the year reading achievement scores. To answer Research Questions 2 and 3, the IV was the intervention type (either single intervention vs. dual intervention) and the pretest and

posttest scores were the DV. Student participants received either a computer-assisted reading intervention only or a computer assisted reading intervention and a direct instruction reading intervention. The computer-assisted reading intervention used was the Compass Learning Odyssey Reading Program.

Compass Learning Odyssey Reading Program. Employees of the Compass Learning Incorporated developed the program as an adaptable and assignable computer-assisted program that provided a diagnostic test of student reading abilities to determine their areas of weakness and then created lessons based on student data (Compass Learning, 2016). Compass Learning was built through the incorporation of input from cognitive psychology and instructional design theories and guidelines; state student performance data; industry association studies; and external product research through focus groups and efficacy studies. The Compass Learning Reading Odyssey program is comprehensive and covers the five essential components of reading recommended by the National Reading Panel Report. In the middle and high school curriculum, the areas of reading fluency, vocabulary development, and reading comprehension strategy instruction were emphasized (Compass Learning, 2016). Teachers were able to customize instruction based on student assessment (Compass Learning, 2016). The administrators of the school district approved for teachers to use the Compass Learning computer-assisted intervention to support the reading skills of students struggling with reading.

SRA Corrective Reading Program. The SRA program is developed and distributed by SRA/McGraw Hill. The program is composed of two parts, decoding and comprehension with levels that increase in difficulty (Institute of Education Sciences, 2013). Each level is designed to last half an academic year except for one series and continue all academic year. All lesson levels contain mastery tests and assessments that monitor and track ongoing student achievement. The SRA lessons will be teacher-led and structured to last for at least 45 minutes, five times per week (Institute of Education Sciences, 2013).

A typical SRA Corrective Reading lesson should last for 45 minutes and include seven to nine short activities that incorporate multiple strands of content that include phonemic awareness, word recognition, vocabulary development, and comprehension. The teacher-led lessons will be repetitive followed by a sequence of modeling a new content, providing guided practice, and implementing individual practice and application. The teacher lessons will be scripted lessons that guide teacher instruction. Signals and group responses will be utilized to keep students motivated and paced. The SRA program lasts one academic year (Institute of Education Sciences, 2013).

Operationalization of Constructs

The variables being defined in the methodology section include the independent variable - type of reading intervention and the dependent variable – reading level as measured by the SRI reading assessment.

Scholastic Reading Inventory (SRI) – SRI is the dependent variable in this research study. The SRI is a computer-adaptive reading assessment program for students

in grades K-12 that measures reading comprehension on the Lexile Framework for Reading (Mersand, 2015). The reading level data collected from the SRI reading assessment is ratio and continuous. A score range of 770-965 represents a basic reading level for seventh grade, however in the school district of the research school a minimum score of 855 was designated as being the basic reading level for grade level promotion (Scholastic, 2014). School administrators at the research school used the 855 score as a guide point in determining reading intervention groups. Students that scored below the minimum score were placed in reading intervention groups.

Compass Learning – Compass Learning is one of the reading interventions used in this research study. Compass Learning is a computer software program designed to close skills and achievement gaps in academic areas using explicit instruction, guided practice, independent practice, and continuous formative assessment (Compass Learning, 2016). Students will be required to complete assigned weekly lessons and assessments to improve their reading skills. Data collected from the Compass Learning program is ratio and continuous. At the research school the level of mastery is set at 80% out of 100%, which is considered satisfactory by Compass Learning Incorporated (Compass Learning, 2016). Students that received the Compass Learning intervention included any student in the reading intervention groups. Students that had reading levels in the range of 854-754 only participated in the Compass Learning reading intervention. Students that had reading levels of 753 and below participated in the Compass Learning reading intervention in addition to a direct-instruction intervention.

SRA Corrective Reading – SRA is one of the reading interventions used in this research study to help increase the reading levels of struggling readers. SRA is a comprehensive, direct-instruction reading intervention program designed to improve the reading performances of students in grades 3-12 reading below grade level (Marchand-Martella, Martella, & Pryzchodzin-Havis, 2005). The SRA reading program is comprehensive because it encompasses the five effective instruction recommendations from the National Reading Panel that include: phonics, phonemic awareness, vocabulary, text comprehension, and fluency building (Marchand-Martella, et al, 2005). The reading achievement score from the SRA reading program is ratio and continuous. At the research school, students will be participating in daily sessions and taking weekly assessments. Students will be required to score at least 80% out of 100% on the weekly formative assessments to progress to the next lesson in the SRA program. Students that participated in the SRA intervention group had reading levels below 753 as measured by the SRI reading assessment.

Data Analysis Plan

I utilized Statistical Package for Social Services (SPSS) to analyze the archived reading comprehension scores of the seventh grade students participating in the study. I visually inspected the collected data and then I used SPSS to further screen the data for outliers and to test for statistical assumptions that need to be met for the ANOVA analysis of the reading comprehension scores. The data collected was analyzed to answer the following research question via testing the corresponding hypothesis.

RQ1: To what extent did reading achievement scores increase for student participants who participated in the dual reading interventions, SRA (direct instruction) and Compass Learning (computer-assisted), and for students who participated in a single reading intervention, Compass Learning (computer-assisted), at the middle school level?

$H_0$1: Students who participated in the dual reading interventions, SRA (direct instruction) and Compass Learning (computer-assisted), and the single reading intervention, Compass Learning (computer-assisted), will not have a significant increase in their reading achievement scores.

$H_1$1: Students who participated in the dual interventions, SRA (direct instruction) and Compass Learning (computer-assisted), and the single reading intervention, Compass Learning (computer-assisted), will have a significant increase in their reading achievement scores.

RQ2: How did student reading achievement scores change from pretest to posttest for participants in the dual reading interventions (i.e., SRA-direct instruction and Compass Learning computer-assisted)?

$H_0$2: Students who participated in the dual reading interventions SRA (direct instruction) and Compass Learning (computer-assisted) will not have an increase in their reading achievement scores from pretest to posttest.

$H_1$2: Students who participated in the dual reading interventions SRA (direct instruction) and Compass Learning (computer-assisted) will have an increase in their reading achievement scores from pretest to posttest.

RQ3: How did student reading achievement scores change from pretest to posttest for participants in the single intervention (i.e., Compass Learning-computer assisted)?

$H_0$3: Students who participated in a single reading intervention, Compass Learning (computer-assisted), will not have an increase in their reading achievement scores from pretest to posttest.

$H_1$3: Students who participated in a single reading intervention, Compass Learning (computer-assisted), will have an increase in their reading achievement scores from pretest to posttest.

I collected reading level data from the two intervention groups two times throughout the intervention period. I analyzed the reading level data from the SRI reading assessment to determine if and to what extent reading achievement scores increased for each intervention group based on their reading intervention and I further evaluated the data to determine how scores differed from pretest to posttest between the intervention groups. I analyzed the collected data via one-way ANOVA statistical test. ANOVA is a statistical test that examines the mean differences of the dependent variables of interest within the sample. The simplest type of ANOVA test is the one-way ANOVA to compare population means (Hesamian, 2016). The alpha level for the ANOVA test was set at .05 and the effect size was set to .06. To ensure validity of the ANOVA analysis, assumptions about the population variance were met which included reading below grade level, receiving special education services for LD in reading, and seventh-grade students (Chandrakantha, 2015).

Threats to Validity

Special care must be taken to ensure that inferences drawn from research studies are true or correct. Threats to validity are specific causes for why inferences drawn from the research results may be incorrect because of covariance, causal relationships, or causation concepts (Creswell, 2012). There are four types of threats to validity that include external validity, internal validity, statistical conclusion validity, and construct validity.

External validity. External validity addresses the extent to which the relationship between the variables can be generalized beyond the study population, setting, and condition. Using random selection increases the likelihood study results will be generalizable to other populations (Rumrill, Cook, & Wiley, 2011). One threat to external validity in the research study is the interaction of selection and treatment. I limited the participating sample population based on reading ability, grade level, and disability categorization to lessen the threat. Another threat to external validity was multiple treatment interferences. Some of the students participating in the study received multiple interventions; therefore conclusions about the effectiveness of one intervention at improving student reading achievement scores could be difficult. The findings from the study are generalizable to similar populations using multiple interventions to improve reading comprehension scores.

Internal validity. Internal validity helps substantiate that the relationship between two variables is causal (Rumrill, Cook, & Wiley, 2011). This research study involved multiple groups who received reading intervention however, the type of

interventions were different, and therefore the groups were compared based on the relevant outcomes of the study. To assess the effectiveness of the reading interventions in the research study I considered several threats to internal validity and addressed them to validate the outcome of the study. The internal validity threats I found in the research study include selection bias; history; maturation; diffusion of treatment; and compensatory rivalry. The threats found in the research study are internal threats commonly found in multiple group research designs (Rumrill, Cook, & Wiley, 2011).

The threats to internal validity that may relate to the student participants in the research study are selection bias, history, and maturation. Selection bias may be a threat to internal validity because the students in the intervention groups are not equal. One group consisted of students who had lower reading levels than the other group. The group of students with the lower reading levels received two reading interventions and the students with higher scores received one reading intervention. The threat to selection bias may be lessened with the random selection of the students in the intervention groups.

History may be a threat to the internal validity of the study because as time passes from the pretest to the posttest, students may have be exposed to factors outside the intervention that could result in the changes in reading levels and not the intervention. Having both groups experience the same activities except for the interventions during the study could control the history threat to internal validity.

Maturation may be a threat to internal validity since the students who will participate in the research study will undergo ongoing developmental processes during the study at different rates. The maturation is assumed to be similar among the student

participants because they share similar characteristics for the study. Selection of the students based on similar characteristics could help address the threat to maturation internal validity.

This research study may not only have threats to internal validity related to students, it may also have a threat related to the interventions. The threats to internal validity that may relate to the interventions are diffusion of treatments. Diffusion of treatment is a social threat to the intervention and occurs when one group learns about the other group either directly or indirectly (Rumrill, Cook, & Wiley, 2011). Diffusion of treatments could be a threat to internal validity because the students from each intervention group could communicate with each other and possibly convey information about their individual interventions. The teachers who administer the interventions could keep the students separated during the intervention times, however the students all attend the same school with the same classes, which could make it difficult to control for this internal threat.

Statistical conclusion validity. Statistical conclusion validity helps researchers determine if the results of the investigation are based on the variables (Rumrill, Cook, & Wiley, 2011). The research study may not have threats to statistical conclusion validity because the statistical tests being implemented are sufficiently rigorous producing the most appropriate statistical power. The SRI assessment, which is the dependent variable for the study, was tested with high levels of reliability employing the Reading Comprehension Assessment reducing the likelihood of poor statistical conclusion validity (Scholastic, 2014).

Ethical Procedures

Ethical procedures help guide research by providing a set of rules or guidelines about what is right and appropriate when conducting research (Rumrill, Cook, & Wiley, 2011). I made all effort to protect the rights of the participating students in the research study. There was not an occasion in the study where student names were disclosed to me. All data utilized in this research study were from archived student data located in the school database that was routinely kept for the school's data collection. Upon IRB approval for the research study, I received all appropriate agreements to gain access to data for analysis. The agreements were from the school district's office of accountability, assessment, and reporting. I did not need parental permission for student participation because the data that was employed in the study was archived student data. Student rights were protected for those who participated in the study because they were not aware of their participation and all data collected on them were routine data collected by school personnel, including special education teachers on a regular basis. The reliability and validity of the data collection instrument and methods reduced my bias.

The data collected were archived data; however, the identity of the student participants was kept confidential and coded prior to being received by me. The administrator providing student data coded it by using a four-digit identification number so that all data collected on the students from various sources were matched to the students. The administrator provided a printout of the SRI achievement score data from fall 2014 through spring 2015 and any other demographic information that was needed for the study such as gender, race, and socioeconomic status.

I kept all documentation collected for the study confidential once I received it by storing it in a locked file cabinet accessible only by myself and on a password-protected computer that was known only to me. The data that were implemented in the research study is kept in a secure location and will be destroyed after five years. Walden University's IRB performed a formal review to ensure all participant human rights were protected. The research study was completed at the school site of the researcher however the students that were studied were students from a different grade level to lessen the ethical concerns.

Summary

The ex-post facto research design was implemented to help determine to what extent the reading intervention strategies helped increase the reading achievement scores of the students in the intervention groups. The research design helped me determine if differences existed from pretest and posttest in reading levels of the groups receiving different interventions. The ex-post facto research design works well for archived data, which were implemented in the study. The following chapter focused on data collection, and the results garnered from the archived data that were applied in the study.

Chapter 4: Reflections and Conclusions

The purpose of this study was to examine the extent that each reading intervention strategy was meeting its intended goal of increasing reading achievement scores. I also sought to determine how reading achievement scores differed from pretest to posttest for the two intervention groups. I used archived reading comprehension scores from the 2014-2015 academic school year for seventh grade students with LD in reading. The students were placed into reading intervention groups based on their fall 2014 reading achievement score. The students who participated in the reading intervention groups were at least one grade level below seventh grade reading expectations. Using this archived pretest and posttest data from the SRI reading assessments, I worked to address the following three research questions and hypotheses:

RQ1: To what extent did reading achievement scores increase for student participants who participated in the dual reading interventions, SRA (direct instruction) and Compass Learning (computer-assisted), and for students who participated in a single reading intervention, Compass Learning (computer-assisted), at the middle school level?

$H_0$1: Students who participated in the dual reading interventions, SRA (direct instruction) and Compass Learning (computer-assisted), and the single reading intervention, Compass Learning (computer-assisted), will not have a significant increase in their reading achievement scores.

$H_1$1: Students who participated in the dual interventions, SRA (direct instruction) and Compass Learning (computer-assisted), and the single reading intervention, Compass

Learning (computer-assisted), will have a significant increase in their reading achievement scores.

RQ2: How did student reading achievement scores change from pretest to posttest for participants in the dual reading interventions (i.e., SRA-direct instruction and Compass Learning computer-assisted)?

$H_0$2: Students who participated in the dual reading interventions SRA (direct instruction) and Compass Learning (computer-assisted) will not have an increase in their reading achievement scores from pretest to posttest.

$H_1$2: Students who participated in the dual reading interventions SRA (direct instruction) and Compass Learning (computer-assisted) will have an increase in their reading achievement scores from pretest to posttest.

RQ3: How did student reading achievement scores change from pretest to posttest for participants in the single intervention (i.e., Compass Learning-computer assisted)?

$H_0$3: Students who participated in a single reading intervention, Compass Learning (computer-assisted), will not have an increase in their reading achievement scores from pretest to posttest.

$H_1$3: Students who participated in a single reading intervention, Compass Learning (computer-assisted), will have an increase in their reading achievement scores from pretest to posttest.

In this chapter, I discuss the data collection procedures, describe the sample and statistical analyses, and present the results of the study.

Data Collection

The data collection process began after obtaining Walden's IRB approval (02-21-18-0406733) and approval to conduct research from the district's Office of Research and Accountability. A school administrator provided me a dataset containing the 2014-2015 SRI reading assessment scores from fall, winter, and spring for each of the 46 student participants. I collected and analyzed these archived SRI reading comprehension scores to determine whether participating in the reading intervention groups increased the SRI reading scores of student participants. All identifying student information was removed and student data for each intervention group were entered into Excel spreadsheets, which were then merged into one combined participant and variable dataset for analysis. The reading comprehension test scores were disaggregated to determine reading growth for each of the reading intervention groups. I analyzed data using SPSS statistical software. To evaluate the mean differences for the SRI data, I used a one-way ANOVA to generate data that I would use to answer each of the research questions and to accept or reject each of the research hypotheses. During data cleaning, I removed scores of students who did not participate in the spring testing session at the research school. Overall, two students were removed from the dataset.

Statistical Analysis of the Reading Interventions

To determine the effect of the reading interventions, I conducted statistical analyses of the archived numerical data obtained from the SRI fall, winter, and spring reading assessments. The school used the SRI reading assessment, a research-based assessment, to ensure reliability of the intervention outcomes. The reading assessment

was aligned with the district's curriculum, and I was granted approval to conduct research using the archived data by the district's Office of Accountability and Research. The SRI reading assessment scores were selected from seventh grade students with LD in reading. I used the reading scores from fall 2014 as the pretest data and the spring 2015 scores as the posttest data. Quantitative analyses were used to determine if students made significant gains in their reading comprehension using a pretest-posttest, nonexperimental design for one-way ANOVA. I used the ANOVA results to measure reading comprehension in response to two reading interventions: SRA in conjunction with Compass Learning, or Compass Learning only. The reading intervention groups were the independent variables in the study and the test scores were the dependent variables. Each of the 46 student participants completed the fall SRI testing session before the implementation of the reading interventions. At the conclusion of the study, 44 student participants completed the spring SRI testing session after participation in the intervention groups.

Data Analysis

I chose a quantitative ex-post facto quasi-experimental design to conduct the statistical analyses for the collected reading achievement data because of its applicability in using archived data from pre-existing groups (see Cohen, Manion, & Morison, 2000; Yurt & Tunkler, 2016). I used the SRI reading assessment scores as ex-post facto data for analyses focused on answering the research questions and addressing each of the hypotheses (see Creswell, 2012). The SRI reading assessment scores were the dependent variables because they were the response variables influenced by the independent

variable (see Creswell, 2012). The independent variables were the two reading intervention groups the students participated in; they remained constant throughout the research study.

The research school administrators determined the reading achievement levels of all students by implementing the SRI reading assessment. Each year students were expected to read at a certain level for promotion to the next grade level. During the 2014-2015 school year the seventh grade expectation score for promotion was an 855. The sample consisted of 46 reading assessment scores of seventh grade middle school students with LD in reading at the research school located in the southeastern United States. The reading scores were from students who scored below grade level expectations (854 and below) on the SRI reading comprehension assessment given fall of 2014. The school used fall 2014 reading score data to divide students into reading intervention groups. I used these scores as pretest data. The reading intervention groups varied in intensity. Students scoring within 100 points of the promotional requirement score of 855 participated in a single reading intervention, Compass Learning, and students scoring more than 100 points from the promotional requirement participated in a dual reading intervention, SRA and Compass Learning. Students stayed in their reading intervention groups for the entire 2014-2015 academic school year, participating in two additional SRI reading assessment sessions for the year. In winter 2014, students participated in a SRI testing session; their scores for the testing session were used as a midpoint assessment to monitor their progress while participating in the intervention

groups. In spring 2015, students participated in their final SRI reading assessment testing session. I used this as their posttest data.

The statistical analyses were conducted using the SPSS computer analysis program for one-way ANOVA testing for analysis of mean differences for three separate SRI reading assessment testing sessions. ANOVA testing produces a test statistic called the *F* ratio along with intervention means and standard deviations (Creswell, 2012). In my presentation of the data analyses, I have included descriptive statistics to show the means and standard deviations. The statistical data produced after performing the one-way ANOVA provided results that helped me determine the extent that the reading intervention strategies were meeting the intended goals of increasing the reading achievement scores of students with LD in reading. Additionally, I analyzed the data to determine how much scores changed for each of the reading interventions groups from pretest to posttest and used the findings to determine which intervention group provided the most substantial reading growth. Of the 46 student participants about 80% ($n = 37$) of the students demonstrated growth as a result of participating in the reading intervention groups.

There were a total of two reading intervention groups, which included 24 (52%) participants in the Compass Learning group and 22 (48%) participants in the SRA and Compass Learning intervention group. The student participant sample consisted of 17 (37%) females and 29 (63%) males. The ages of the student participant samples ranged from ages 12 to 15. The ethnicities of the sample consisted of 15 (33%) white, 22 (48%) African American, 6 (13%) Hispanic, and 3 (7%) multicultural students. Table 1 shows

the frequencies and percentages for the student characteristics of gender, age, and ethnicity.

Table 1

Student Characteristics

	Computer-assisted reading intervention		Computer-assisted and direct instruction reading intervention	
Characteristic	*N*	%	*N*	%
Gender				
Male	16	67	13	59
Female	8	33	9	41
Age				
12	8	33	5	23
13	15	63	10	45
14	1	4	6	27
15	0	0	1	5
Ethnicity				
White	10	42	6	27
African American	11	46	10	45
Hispanic	1	4	5	23
Multicultural	2	8	1	5

The sample used for this study was representative of the seventh grade special education population of students at the research site. Although the disabilities of the students at the research school ranged from severe intellectual disabilities to other health impairments, a majority of the students receive special education services for a specific learning disability in reading comprehension and/or math reasoning. The reading interventions for the student participants were administered as planned without many challenges. Two student participants did not take the SRI posttest in spring 2015 because they did not attend the research school at that time. Test score descriptives for the seventh grade student participants from fall 2014 to spring 2015 are presented in Table 2. Table 2 shows the student testing session, the minimum and maximum scores, the mean scores, and standard deviations for all seventh grade participants.

Table 2

Test Score Descriptive for the Fall 2014 to Spring 2015 Seventh Grade Student Participants

	Minimum	Maximum	Mean	Standard deviation
SRI Fall 2014	231	853	670.48	181.15
SRI Winter 2014	179	1023	714.49	213.10
SRI Spring 2015	329	1149	777.64	198.06

ANOVA Results

The one-way Welch ANOVA data analyses generated a table detailing the mean and standard deviations for the SRI assessments along with an *F* ratio based on SRI data. The *F* ratio compares the actual mean differences using variance to assess the size of the differences. The ANOVA analyses produced after a value for the *F* ratio and the level of significance are presented providing inferential parametric results. The value of the *F*

Test statistic in the research study was 32.01 with a significance value of .000 using a .05 level of significance.

Utilizing SPSS, I analyzed the reading achievement scores for students with LD in reading receiving reading interventions in two different intervention groups. A one-way ANOVA statistical test and descriptive statistics were conducted using the student reading score data. Research Question 1 was used to help me determine the overall reading growth on the SRI reading assessment for all student participants regardless of intervention type. Research Question 2 compared the reading score changes from pretest to posttest for students that participated in dual reading interventions (Compass Learning and SRA). Research Question 3 compared the reading score changes from pretest to posttest for students that participated in a single reading intervention (Compass Learning).

Research Question 1

To what extent did reading achievement scores increase for student participants who participated in the dual reading interventions, SRA (direct instruction) and Compass Learning (computer-assisted) and for students who participated in a single reading intervention, Compass Learning (computer-assisted) at the middle school level?

Research Question 1 focused on each of the 46 student participants' archived reading assessment scores. To answer Research Question 1, I conducted a one-way Welch ANOVA to examine the group differences in the scores of students participating in a single reading intervention (Compass Learning) and students participating in a dual reading intervention (Compass Learning and SRA). Participants were classified into two

groups: Compass Learning (n = 24) and Compass Learning and SRA (n = 22). The assumption of homogeneity of variance was violated as assessed by Levene's test for equality of variances (p = .30). The reading comprehension scores increased from fall (n = 46, M = 670.48, SD = 184.15) to spring (n = 44, M = 777.64, SD = 198.06), with differences that were statistically significant, Welch's F (1, 34.48) = 32.01, p = .000. A post hoc analysis was not performed on the data because there were only two groups being compared. The group means were statistically significant and therefore the null hypothesis was rejected and the alternate hypothesis was accepted. The results indicated that a statistically significant increase in reading achievement scores occurred after students participated in both the dual reading intervention group and the single reading intervention group. Table 3 presents a summary of the one-way ANOVA findings.

Table 3

Summary of ANOVA for SRI reading groups

SRI Reading Change Scores					
	Sum of squares	df	Mean square	*F*	*p*
Between Groups	744287.12	1	744287.12	34.48	.000
Within Groups	942565.06	42			
Total	1686852.18	43			

Note. A p-value < .05 indicates a statistically significant value.

Research Question 2

How did student reading achievement scores change from pretest to posttest for participants in the dual reading interventions (i.e., SRA- direct instruction and Compass Learning-computer assisted)?

Research Question 2 focused on the 22 students who did not score at least a minimum of 855 on the SRI reading assessment and failed to meet the district's requirement for reading at grade level expectations. The goal reading score on the SRI reading assessment was 855 to demonstrate reading at the basic seventh grade level. The student participants in this group were reading far below grade level expectations, at least two grade levels behind with scores ranging from 753 to 0. The student participants in the group participated in dual reading interventions, Compass Learning and SRA. To answer Research Question 2, the descriptive statistical data produced when conducting the ANOVA analyses was used to compare the group score means for students who participated in the dual reading interventions (Compass Learning and SRA) from fall 2014 (pretest) to spring 2015 (posttest). The statistical analyses revealed that the mean score from fall (M= 515.32, SD = 150.90) to spring (M= 641.52, SD = 177.65) increased by 25% (mean difference of 126.20 points) for students who participated in the dual interventions. The midpoint data collected in winter 2014 (M= 541.43, SD = 177.97) revealed a mean increase from fall 2014 (M= 515.32, SD = 150.90), which was a 5% (mean difference of 26.11 points) increase for the dual intervention group. In spring when the posttest data were collected, the mean increased for the intervention group overall, with a minimum score of 329 and a maximum score of 988. The spring mean

posttest scores (*M*= 641.52, *SD* = 177.65) did not meet the goal promotional requirement of 855 for the research school, however the group demonstrated reading achievement score gains from pretest to posttest. It was hypothesized that the dual reading interventions would result in students scoring at higher levels from pretest to posttest after participating in their reading intervention group. The null hypothesis for Research Question 2 was rejected and the alternative hypothesis was accepted, students who participated in the dual reading interventions did increase their scores from pretest to posttest. These data showed an increased mean when comparing pretests to posttests, the mean difference obtained was 126.20 (25%) for the student participants. Results of the descriptive analysis are presented in Table 4.

Table 4

Test Score Descriptive for the Fall 2014 to Spring 2015 Dual Intervention Student Participants

	N	Minimum	Maximum	Mean	Standard deviation
SRI Fall 2014	22	231	738	515.32	150.90
SRI Win. 2014	21	179	757	541.43	177.97
SRI Sp. 2015	21	329	988	641.52	177.65
Gains (%)				126.20 (25)	

Research Question 3

How did student reading achievement scores change from pretest to posttest for participants in the single intervention (i.e., Compass Learning- computer assisted)?

Research Question 3 focused on the 24 student participants who did not score at

least an 855 on the SRI reading assessment and failed to meet the district's requirement for reading at grade level expectations. The student participants in this group were reading one grade level below expectations with scores ranging from 854 – 754. The student participants in this group participated in the single reading intervention, Compass Learning. To answer Research Question 3, the descriptive statistical data produced from conducting the ANOVA analyses were used to compare the group means for students who participated in the single reading intervention (Compass Learning) from fall 2014 (pretest) to spring 2015 (posttest). The statistical analyses revealed that the mean score from fall (M= 812.71, SD = 37.67) to spring (M= 901.91, SD = 118.97) increased by 11% (mean difference of 89.20 points) for students who participated in the single intervention. The midpoint data collected in winter 2014 (M= 865.92, SD = 89.76) revealed a mean increase from fall 2014 (M= 812.71, SD = 37.67), which was a 7% (mean difference of 53.21 points) increase for the single intervention group. In spring when the posttest data were collected, the mean increased for the intervention group overall, with a minimum score of 725 and a maximum score of 1149. The spring mean posttest scores (M= 901.91, SD = 118.97) met the goal promotional requirement of 855 for the research school showing gains in reading achievement scores for the Compass Learning intervention group from pretest to posttest. The null hypothesis for research question 3 was rejected and the alternative hypothesis was accepted, students who participated in the single reading intervention did increase their reading achievement scores from pretest to posttest. Table 5 provides descriptive statistics for the pretest and posttest score data summarizing the minimum and maximum scores, means, and standard deviations for the

group participants. I concluded that the Compass Learning intervention helped increase the reading achievement scores of participants within one grade level behind grade level reading expectations.

Table 5

Test Score Descriptive for the Fall 2014 to Spring 2015 Single Intervention Student Participants

	N	Minimum	Maximum	Mean	Standard deviation
SRI Fall 2014	24	702	853	812.71	37.67
SRI Win. 2014	24	648	1023	865.92	89.76
SRI Sp. 2015	23	725	1149	901.91	118.97
Gains (%)				89.20 (11)	

Student score differences by intervention type are presented in Table 6. Students who participated in the single reading intervention Compass Learning, had gains of 79% overall on their SRI posttest reading assessment and 21% of the student scores showed a decrease or unchanged points on their posttest SRI assessment. This finding provided support that the Compass Learning intervention was an effective intervention for students who were one grade level behind reading expectations at the research school. Students who participated in the dual reading interventions, Compass Learning and SRA, also demonstrated positive overall gains. For the dual interventions, 82% of the students showed score gains on the posttest and 18% of the students showed a decrease or unchanged points on their posttest assessment. This finding provided support that students who were reading far below grade level expectations benefit from receiving dual

reading interventions such as Compass Learning and SRA direct instruction. The frequencies and percentages of difference on the posttest scores based on the intervention type are presented in Table 6.

Table 6

Frequencies and Percentages on Difference Scores by Intervention Type

Characteristics	Computer-assisted reading intervention *n*	%	Computer-assisted and direct instruction reading intervention *n*	%
Lost points or unchanged	5	21	4	18
Gained points	19	79	18	82

Findings of the Study

One-way ANOVA testing based on the SRI reading assessment data of students with LD in reading at the research school indicated that 46 students participating in reading intervention groups obtained a statistically significant increase in their reading achievement scores at the conclusion of both the Compass Learning and SRA intervention group and the Compass Learning intervention group. For Research Question 1 the ANOVA analyses showed that the null hypothesis was rejected at a 95% confidence level because the *p* value was less than .05. This finding indicated that there was a statistically significant difference in the SRI reading test scores of seventh grade students with LD in reading who participated in the different reading intervention groups.

Research Questions 2 and 3 were answered using the descriptive statistics produced when conducting the one-way ANOVA analyses on the data. The results of data analyses demonstrated a substantial increase in reading scores on the SRI reading assessment for the student participants after participation in both the computer-assisted and computer-assisted and direct instruction interventions. Research Question 2 was analyzed to determine if there was a change in student participant SRI assessment scores from pretest to posttest for students who participated in the dual reading interventions. The differences in pretest and posttest means indicated there was an increase in the reading achievement scores of students who participated in both the Compass Learning and SRA intervention. Data analyses for Compass Learning and SRA reading intervention group demonstrated that student participants increased their SRI reading achievement scores after participating in the intervention group. Research Question 3 was also analyzed to determine if there was an increase in student participant SRI scores from pretest to posttest after participating in the Compass Learning reading intervention. The differences in pretest to posttest means indicated that there was an increase in student reading scores after participating in the reading intervention group.

The single reading intervention group – Compass Learning, had more students increase their SRI reading achievement scores to the district's promotional requirement score of 855 than the dual reading intervention group. The majority of the student participants in the dual reading intervention group – Compass Learning and SRA, did not meet the district's promotional requirement score of 855 however, they gained the most points on their SRI reading achievement assessment from pretest to posttest. The null

hypothesis was rejected for each of the research questions implying that significant increases resulted because of the reading interventions the students participated in. The *p*-value for the reading interventions was significant, $p = .000$ for change in reading scores for all student participants. There was a significant change in the reading achievement scores on the SRI reading assessment for the 46 students who participated in the reading intervention groups. The overall findings from these data analyses indicated that students with LD in reading struggling with reading comprehension at the middle school level benefit from reading interventions that are both computer-assisted and taught through direct instruction.

Summary

Two reading intervention groups were created at the research school in the southeastern United States to address the deficient reading comprehension skills of middle school students with LD in reading. The reading intervention groups varied in complexity depending on the pretest reading scores on the district-administered SRI reading assessment given fall 2014. If students scored more than 100 points from the promotional requirement score of 855, which was equivalent to at least two grade levels behind, they participated in the computer-assisted and direct instruction interventions that utilized Compass Learning and SRA. If students scored within 100 points of the district's seventh-grade promotional requirement score of 855, which was equivalent to one grade level behind, they participated in the computer-assisted reading intervention group that utilized Compass Learning. Ex-post facto data obtained from the 2014-2015 SRI reading assessment was used for the one-way ANOVA analyses to address each of

the Research Questions and Hypotheses for determining the effectiveness of the interventions. These data were used to determine whether the interventions helped students increase their scores at statistically significant levels. The findings from the data analyses established support that reading interventions may have a positive and significant effect on the reading achievement scores for students with LD in reading. Implementing computer-assisted and direct instruction interventions may result in positive outcomes for struggling readers. The computer-assisted and direct instruction interventions were used as instructional supports to help students improve their reading comprehension skills that would in turn increase their reading scores. I hypothesized that the reading interventions would increase the reading scores of the student participants despite the reading intervention they participated in and the data analyses confirmed the hypotheses that the Compass Learning only group and the Compass Learning and SRA group had positive and significant effects on the reading comprehension scores reached via the SRI reading assessment. I also hypothesized that the students who participated in either intervention group would increase their reading achievement scores from pretest to posttest; data analyses revealed that a majority of the students increased their scores from pretest to posttest. These data implied that reading comprehension skills improve for students with LD in reading after participating in reading interventions.

Students with LD in reading participated in reading intervention groups for the 2014-2015 academic school year at the research school after being placed in them after their pretest taken fall 2014. Findings from the data analyses indicated that implementing reading interventions to students with LD in reading could help them gain a deeper

understanding of written text. Chapter 5 will provide an overview of the study, the results of the study explained, and the social implications of providing intervention for struggling readers are discussed. Recommendations are also provided in the section for future studies.

Chapter 5: Discussion, Conclusions, and Recommendations

The purpose of this quantitative ex-post facto quasi-experimental study was to determine the extent the reading intervention strategies implemented at the research school were meeting the intended goals of increasing the reading achievement scores for students with LD in reading. Another purpose of the study was to determine if there was a change in reading achievement scores from pretest to posttest for students participating in Compass Learning and SRA (dual reading interventions) and for students participating in Compass Learning (single reading intervention) only. I posed three research questions to investigate how implementing reading interventions for seventh-grade students with LD in reading would change their reading achievement scores on the SRI reading assessments given fall, winter, and spring. The study site used SRI, a research-based reading assessment, to ensure reliability of assessment score data. The reading assessment was aligned with the school district's reading curriculum and was implemented throughout the district in all elementary and middle schools. The research site personnel provided me access to data after approval to conduct research came from the district's Office of Accountability and Research and Walden University's IRB. I used archived reading test score data from the 2014-2015 academic school year. The reading scores from fall 2014 testing session were used as pretest data and the spring 2015 test scores were used as the posttest data.

Overview of Findings

I used a one-way ANOVA of pretest and posttest data. The study was implemented with a quantitative ex-post facto research design utilizing SRI reading

assessment scores derived from a convenience sampling of 46 seventh grade students with LD in reading. The sample size was determined by the availability of students with LD in reading at the research school. There were 22 student participants in the Compass Learning and SRA group and 24 student participants in the Compass Learning only group. I analyzed the assessment scores of the two groups of seventh grade student's fall 2014 and spring 2015 to determine whether there was a difference in reading achievement scores as assessed by the SRI reading assessment as a result of reading interventions. One-way ANOVA showed statistically significant differences in the reading achievement scores of the student participants after their participation in either the dual reading intervention or in the single reading intervention. Data analyses also showed increases in reading achievement scores from pretest to posttest for both intervention groups. This chapter included an interpretation of the findings, conclusions, and recommendations. In addition, I discuss the social change implications and offer recommendations for future studies.

Interpretation of the Findings

The purpose of this study was to determine (a) the extent the reading intervention strategies were meeting the intended goals of increasing reading achievement scores for students with LD in reading, and (b) how much scores changed for each of the two reading intervention groups from pretest to posttest at the research school. Data generated for each of the research questions indicated support for the assertion that computer-assisted and direct instruction interventions were advisable interventions to pursue for increasing the reading comprehension scores of students with LD in reading.

I reviewed my data analyses to determine if the research questions and corresponding hypotheses resulted in increased reading comprehension scores for the student participants as measured by the SRI reading assessment. Three separate analyses were conducted over the course of the 2014-2015 academic school year of the 46 student participants SRI reading assessment scores. Two students moved during the school year, so the posttest analyses were based on 44 student participant scores. As stated in Chapter 4, I used one-way ANOVA to compare the pretest and posttest data for both intervention groups. Each of the student's SRI scores were evaluated to discern the extent students responded to the reading interventions. During data analyses, I computed an *F* statistic that indicated that there was a statistically significant mean difference when comparing reading achievement scores for students enrolled in reading intervention groups for the entire academic year. Other essential questions answered for this study were whether changes in scores from pretest to posttest existed for students receiving dual reading interventions or a single reading intervention.

An analysis of the SRI reading assessment mean scores produced over three points during the year showed that students participating in the dual reading intervention experienced the most reading growth among those in the intervention groups. Data presented in Table 4 showed that dual reading interventions produced positive results for a majority of the student participants. The computer-assisted and direct instruction intervention may be a positive approach to use to supplement or teach reading to students with LD in reading. Data presented in Table 5 showed that single reading interventions also provided gains in reading achievement score for the student participants. Utilizing

only a computer-assisted intervention can be a viable strategy for teaching students with LD in reading who are reading one grade level behind. Both the Compass Learning and SRA intervention group and the Compass Learning group had a positive effect on the reading achievement of students with LD in reading according to statistical data. The Compass Learning and SRA group showed the most achievement score point gains, and the Compass Learning group had the most students meet the 855 district promotional requirement score for seventh grade students.

I evaluated student score differences by intervention types to find the number of students who lost points or did not have a change in points, and students who gained points as a result of the intervention types. Analyses of the data helped me determine that a majority (79%) of students who participated in the Compass Learning intervention gained points, and a majority (82%) of students who participated in the Compass Learning and SRA group also gained points on the SRI reading assessment. These percentages support the notion that by participating in one of the reading intervention groups, students' reading achievement scores will increase. These data indicated that 37 out of the 46 total students who participated in the reading intervention groups benefitted from participating in the reading intervention groups.

The study finding supported the premise that reading intervention strategies assist some students in reaching higher reading comprehension scores. The one-way ANOVA statistical test indicated positive study outcomes. Statistical significance was achieved with consistent results for students who participated in both the computer-assisted and direct instruction reading interventions and the computer-assisted intervention. These

findings indicated that computer-assisted and direct instruction interventions might be meaningful components to add to a reading intervention curriculum. My study results indicated that students experienced higher reading achievement scores after participation in targeted reading interventions. These findings further showed that students who were one grade level behind in their reading scores and participated in the computer-assisted intervention were responsive to that intervention alone, met promotional requirements, and did not require the additional support of direct instruction. Despite that finding, a large number of the population did need more intense remediation that included computer-assisted and direct instruction intervention in order to make gains in their reading achievement scores. Overall, both reading intervention types demonstrated success with the population studied.

Literature Findings

Researchers have found that students with LD must be taught with interventions tailored to their specific needs. Therefore, the need to find effective reading interventions is essential (Moreau, 2014). Research by Moreau (2014) showed that 30% of middle school students with reading-related LD require specific, intensive, and explicit reading instruction either individually or in small groups to meet grade level reading standards. Jitendra and Gajria (2014) found that when students with LD are provided with appropriate strategies and instructions, they learn to comprehend text adequately. Overall, this study supported the findings of previous researchers that implementing reading interventions supports improved reading comprehension. Results from my study showed that reading comprehension scores increased for all student participants from fall

2014 (M = 670.48, SD = 181.15) to spring 2015 (M = 777.64, SD = 198.06) at a statistically significant level p = .000 on the SRI reading assessment.

Computer-assisted and direct reading instruction that incorporates background knowledge, vocabulary development, and the comprehension of the relationships between concepts, ensure understanding and retention of reading material. Direct instruction has long been used as a way to assist struggling readers with reading comprehension (Stockard & Engelmann, 2010). Proctor et al. (2014) conducted a study using both direct instruction and computer-assisted instruction and found that students who participated in the intervention groups outperformed those in a control group who received only traditional reading instruction. The findings from this study indicated that using direct instruction and computer-assisted instruction does help students with LD in reading improve their reading comprehension skills. For the Compass Learning and SRA intervention group, the reading achievement scores increased from fall 2014 (M = 515.32, SD = 150.90) to spring 2015 (M = 641.52, SD = 177.75), which was a 25% increase. According to the data, 82% (n = 18) of the students had gains on their SRI assessment as a result of participating in the dual reading intervention.

Computer-assisted instruction software is able to provide students with immediate feedback, which can be used to offer a more tailored learning experience (Falth et al., 2013). Baier et al. (2013) determined that computer-assisted instruction was a viable strategy for teaching struggling readers in middle school; this methods produced the greatest improvements in their reading study comparing various reading interventions. At the research site, Compass Learning was the computer-assisted reading intervention

used to assist students with improving their reading comprehension. For the Compass Learning intervention group, the reading achievement scores increased from fall 2014 (*M* = 812.91, *SD* = 37.67) to spring 2015 (*M*= 901.95, *SD* = 118.97), which was an 11% increase. According to the data, 79% (*n*= 19) of the students in the Compass Learning group had gains on their SRI reading assessment as a result of participating the single reading intervention.

Theoretical Framework

This study was grounded in a CLT that focuses on WM. WM is needed to learn new knowledge (Loosli, 2012). Researchers have shown that low WM is often associated with poor reading comprehension (Cowan, 2014; Garcia-Madruga et al., 2013). Readers with comprehension difficulties find reading daunting because it is a cognitively demanding task. Students with LD in reading often have WM issues that interfere with their ability to process, resulting in an overload of their cognitive processes. CLT is a way to organize information and not overwhelm cognitive processes (Gredler, 2012). Researchers have reported that students with low WM capacity need additional support because of their short attention spans. Cognitive abilities can change with the use of interventions such as direct instruction tailored to student needs to improve reading comprehension.

Limitations of the Study

A few limitations were evident at the research school site and with the student participants. This study was limited only to the participating school, in a school district located in the southeastern United States. The school district used reading interventions as a means of improving the reading comprehension scores of students across the district. The student participant scores were selected using a convenience sampling. The student participants were seventh grade students with LD who were reading below grade level expectations as a result of the SRI reading assessment scores produced in fall 2014. The students were placed in reading groups based on their initial fall SRI score and remained in the same intervention group for the remainder of the academic year. The interventions took place for one year, which limits the effect of the intervention to short term results. This study did not include the effects of the interventions on other grade levels nor did it include students not receiving special education services for LD in reading. The findings of the study are not generalizable to all students because the sample size of 46 participant scores is small; this limits the findings of the study to this group of students and other groups with similar characteristics. Another noted limitation was that the data can be slightly misleading because data analyses began with 46 student participant scores and ended with 44 student participant scores. The intervention group sizes were not equal which could have also slightly skewed the findings.

Recommendations

The present study provided encouraging results for reading instruction. It reiterated how essential it is for teachers working with struggling readers to understand

the reading process and have a plan in place to effectively teach all levels of learners (Garner, 1987). The results of this research study may help educators gain a better understanding of the different reading interventions available to teachers to utilize in the classroom. Both reading intervention groups presented in this study had a positive effect on student academic progress in reading. Computer-assisted interventions such as Compass Learning can aid students in remediating and extending their learning by providing immediate feedback and individualized lessons tailored to their specific areas of need (Falth, et. al, 2013). Direct instruction interventions such as SRA allow students to receive intensive reading instruction that targets specific reading deficits in a structured manner designed to improve their reading skills (Vaughn & Wanzek, 2014). In terms of schools and school districts, schools employing reading interventions such as Compass Learning and SRA should continue to refine interventions and provide the most efficient methods. Schools limited on resources can decide which type of interventions to implement that will produce significant changes that are most cost effective. For teachers, the results of this study could be used so they may be better equipped to assist students by implementing reading interventions as an integral part of their reading instruction from the onset. The results of the study can also deepen the knowledge base of teachers and assist them in understanding the complexities involved in the task of reading. Students with LD in reading often do not actively participate in their reading instruction; by implementing reading interventions, students may be more engaged in their learning and motivated to participate in their remediation.

This study can be used as a model of effective reading intervention instruction and shared with school personnel who have struggling readers who need help to improve their reading achievement scores. This study can provide stakeholders with knowledge of computer assisted and direct instruction interventions that have been proven to help struggling readers. This study can be extended to include other middle school grade levels and high schools students with LD in reading comprehension to gain a broader perspective on the effects of reading comprehension.

Implications

There is a national need for students to not only know how to read words but to also be able to comprehend and understand what they read. As stated in Chapter 1 middle school students are reading at poor levels especially those receiving special education (Cortiella & Horowitz, 2014). I provided evidence to support the importance of using reading interventions to improve reading comprehension so that all students, especially those with disabilities are able to progress academically and socially. The study results may be used to enable school administrators to make educated decisions about implementing reading interventions. I also demonstrated with this study that students with disabilities placed in reading intervention groups could increase their reading achievement scores, suggesting that the reading interventions do have the potential to improve reading achievement.

There is much research that has advocated for the use of computer-assisted and direct instruction when remediating the reading comprehension skills of struggling readers. Computer-assisted and direct instruction encourages students to engage with

written text, ultimately improving their reading comprehension skills. The study results may help school administrators decide how to best use their reading resources to improve reading scores. The outcomes for improving the reading comprehension levels for students with LD in reading can be empowered students who will be in a better position to compete academically and socially to become productive and responsible citizens.

Data analyses presented in Chapter 4 exhibited how reading instruction can be supplemented with technology and structured instruction. For future studies, other well-researched computer-assisted and direct instruction interventions can be used such as MobyMax for Reading and Read Theory instead of Compass Learning and Funnix Reading and Reading Mastery instead of SRA. A more diverse participant sample could also be used. I focused on one grade level of middle school students with disabilities in LD, future studies could include different middle school grade levels as well as students from elementary and high school. The study was conducted in a suburban setting; the results could differ if it was carried out in rural or urban school settings. I compared different intervention groups using different intervention types, a study could be conducted that focused on one intervention type for different intervention groups. The study could also be beneficial to students without disabilities who are struggling readers. The motivation of teachers participating in this study was not investigated however exploring their motivations could provide powerful insights into the types of reading interventions teachers are comfortable implementing within their classrooms.

Conclusion

The purpose of this quantitative ex-post facto quasi-experimental study was to determine the extent the reading intervention strategies implemented at the research school were meeting the intended goals of increasing the reading achievement scores as well as determining how much scores changed for each of the two reading intervention groups from pretest to posttest. Sustained interventions and support were determined to be essential to the success of struggling readers especially those with reading disabilities (Vaughn & Wanzek, 2014). Researchers have found that best practice is to individualize student learning and support differentiation with the use of varying reading intervention types (Roskos & Neuman, 2014). In an effort to provide instruction that would significantly affect reading achievement scores via SRI, computer-assisted and direct instruction interventions were implemented at the research school. This research study along with other researchers in the field of reading comprehension have found that students with LD in reading benefit from receiving research-based reading interventions implemented consistently over time.

References

Ashkenazi, S., Black, J. M., Abrams, D. A., Hoeft, F., & Menon, V. (2013). Neurobiological underpinnings of math and reading learning disabilities. *Journal of Learning Disabilities*, *46*(6), 549-569. doi: 10.1177/0022219413483174

Ayres, P., & Paas, F. (2012). Cognitive load theory: New directions and challenges. *Applied Cognitive Psychology*, *26*(6), 827-832. doi: 10.1002/acp.2882

Baier, H. (2013). Synaptic laminae in the visual system: Molecular mechanisms forming layers of perception. *Annual Review of Cell and Developmental Biology, 29*, 385-416. doi: 10.1146annualrev-cellbio-101011-155748

Benner, G. J., Nelson, R. A., Stage, N. A., & Ralston, C. (2010). The influence of fidelity of implementation on the reading outcomes of middle school students experiencing reading difficulties. *Remedial and Special Education 32*(1), 79-88. doi: 10.1037/h0100473

Binder, C., & Watkins, C. L. (2013). Precision teaching and direct instruction: Measurably superior instructional technology in schools. *Performance Improvement Quarterly*, *26*(2), 73-115. doi: 10.1002/piq.21145

Botsas, G. (2017). Differences in strategy use in the reading comprehension of narrative and science texts among students with and without learning disabilities. *Learning Disabilities, A Contemporary Journal, 15*(1), 139-162. Retrieved from http://eric.ed.gov

Büttner, G., & Shamir, A. (2011). Learning disabilities: Causes, consequences, and responses. *International Journal of Disability, Development and Education*, *58*(1), 1-4. doi:10.1080/1034912x.2011.548450

Cantrell, S. C., Almasi, J. F., Carter, J. C., & Rintamaa, M. (2012). Reading intervention in middle and high schools: Implementation fidelity, teacher efficacy, and student achievement. *Reading Psychology, 34*(1), 26-58. doi: 10.1080102702711.2011.577695.

Chandler, P., & Sweller, J. (1996). Cognitive load while learning to use a computer program. *Applied Cognitive Psychology*, *10*(2), 151-170. doi: 10.1002/(SICI)1099-0720(199604)10:2%3C151::AID-ACP380%3E3.0.CO;2-U

Chandrakantha, L. (2015). Simulating one-way ANOVA using resampling. *The Electronic Journal of Mathematics and Technology, 94*(4), 281-296. Retrieved from http://php.radford.edu

Cheung, A. C., & Slavin, R. E. (2013). Effects of educational technology applications on reading outcomes for struggling readers: A best evidence synthesis. *Reading Research Quarterly*, *48*(3), 277-299. doi: 10.1002/rrq.50

Chikasanda, V. K. M., Otrel-Cass, K., Williams, J., & Jones, A. (2013). Enhancing teachers' technological pedagogical knowledge and practices: A professional development model for teachers in Malawi. *International Journal of Technology and Design Education, 23*, 597-622. doi:10.1007/s10798-012-9206-8

Cobb, A. (2010). To differentiate or not to differentiate?. *Quarterly Review of Distance Education*, *11*(1), 37-45. Retrieved from http://www.infoagepub.com/quarterly review-of-distance-education.html

Cohen, L., Manion, L., & Morrison, K. (2000). Naturalistic and ethnographic research. *Research Methods in Education, 5*, 137-157. Retrieved from https://www.questia.com/library/103778255/research-methods-in-education

Compass Learning. (2016). The research behind compass learning odyssey. Retrieved from http://www.compasslearning.com

Connor, C. M., Spencer, M., Day, S. L., Guiliani, S., Inglebrand, S. W., McLean, L., & Morrison, F. J. (2014). Capturing the complexity: Content, type, and amount of instruction and quality of the classroom learning environment synergistically predict third graders' vocabulary and reading comprehension outcomes. *Journal of Educational Psychology, 106*(3), 762-778. doi: 10.1030035921

Cortiella, C., & Horowitz, S. H. (2014). The state of learning disabilities: Facts, trends, and emerging issues. Retrieved from the National Center for Learning Disabilities website https://www.ncld.org/wp-content/uploads/2014/11/2014-State-of-LD.pdf

Cowan, N. (2014). Working memory underpins cognitive development, learning, and education. *Educational Psychology Review*, *26*(2), 197-223. doi: 10.100710648-013-9246-y

Creswell, J. W. (2012). *Educational research: Planning, conducting, and evaluating quantitative and qualitative research* (Laureate custom ed.). Boston, MA: Pearson Education.

Darabi, A., & Jin, L. (2013). Improving the quality of online discussion: The effects of strategies designed based on cognitive load theory principles. *Distance Education*, *34*(1), 21-36. doi:10.1080/01587919.2013.770429

De Winter, J. C. (2013). Using the student's *t*-test with extremely small sample sizes. *Practical Assessment, Research & Evaluation*, *18*(10), 1-12. Retrieved from https://pareonline.net/pdf/v18n10.pdf

Decker, S. L., Hale, J. B., & Flanagan, D. P. (2013). Professional practice issues in the assessment of cognitive functioning for educational applications. *Psychology in the Schools*, *50*(3), 300-313. doi:10.1002/pits.21675

Derry, S. J. (1996). Cognitive schema theory in the constructivist debate. *Educational Psychologist*, *31*(3-4), 163-174. doi: 10.1080/00461520.1996.9653264

Engelmann, S., Arbogast, A., Bruner, E., Lou Davis, K., Engelmann, O., Hanner, S., et al. (2002). *SRA reading mastery plus*. DeSoto, TX: SRA/McGraw-Hill.

Faggella-Luby, M., & Wardwell, M. (2011). RTI in a middle school: Findings and practical implication of a tier 2 reading comprehension study. *Learning Disability Quarterly*, *34*(1), 35-49. doi: 10.1177073194871103400103

Fälth, L., Gustafson, S., Tjus, T., Heimann, M., & Svensson, I. (2013). Computer-assisted

interventions targeting reading skills of children with reading disabilities: A longitudinal study. *Dyslexia*, *19*(1), 37-53. doi: 10.1002/dys.1450

Faul, F., Erdfelder, E., Lang, A. G., & Buchner, A. (2007). G-power 3: A flexible statistical power analysis program for the social, behavioral, and biomedical sciences. *Behavior Research Methods, 39*(2), 175-191. Retrieved from https://link.springer.com/journal/13428

Faul, F., Erdfelder, E., Buchner, A., & Lang, A.G. (2009). Statistical power analyses using G*Power 3.1: Tests for correlation and regression analyses. *Behavior Research Methods*, *41*, 1149-1160. Retrieved from https://link.springer.com/article/10.3758/BRM.41.4.1149

Fogarty, M., Oslund, E., Simmons, D., Davis, J., Simmons, L., Anderson, L., & Roberts, G. (2014). Examining the effectiveness of a multicomponent reading comprehension intervention in middle schools: A focus on treatment fidelity. *Educational Psychology Review*, *26*(3), 425-449. doi: 10.1007/10648-014-9270-6

Fuchs, L. S., Fuchs, D., & Compton, D. L. (2010). Rethinking response to intervention at middle and high school. *School Psychology Review*, *39*(1), 22-28. Retrieved from http://naspjournals.org

García-Madruga, J. A., Elosúa, M. R., Gil, L., Gómez-Veiga, I., Vila, J. Ó., Orjales, I., Contreras, A., ... Duque, G. (2013). Reading comprehension and working memory's executive processes: An intervention study in primary school students. *Reading Research Quarterly*, *48*(2), 155-174. doi: 10.1002/rrq.44

Gerjets, P., Scheiter, K., & Cierniak, G. (2009). The scientific value of cognitive load theory: A research agenda based on the structuralist view of theories. *Educational*

Psychology Review, *21*(1), 43-54. doi: 10.1007/s10648-008-9096-1

Gersten, R., Fuchs, L. S., Williams, J. P., & Baker, S. (2001). Teaching reading comprehension strategies to students with learning disabilities: A review of research. *Review of Educational Research*, *71*(2), 279-320. doi: 10.31022F00346543071002279

Gibson L., Cartledge, G., & Keyes, S. E. (2011). A preliminary investigation of supplemental computer-assisted reading instruction on the oral reading fluency and comprehension of first-grade African American urban students. *Journal of Behavioral Education*, *20*(4), 260-282. doi: 0.1007/s10864-011-9136-7

Gorozidis, G., & Papaioannou, A. G. (2014). Teachers' motivation to participate in training and to implement innovations. *Teaching and Teacher Education*, *39*, 1-11. doi: 10.1016/j.tate.2013.12.001

Graves, A. W., Brandon, R., Duesbery, L., McIntosh, A., & Pyle, N. B. (2011). The effects of tier 2 literacy instruction in sixth grade: toward the development of a response-to-intervention model in middle school. *Learning Disability Quarterly, 34*(1), 73-86. doi: 10.11772F073194871103400105

Gravetter, F., & Wallnau, A. L. (2008). *Essentials of statistics for the behavioral sciences*. Belmont, CA.: Wadsworth-Cengage Learning.

Gredler, M. E. (2012). Understanding Vygotsky for the classroom: Is it too late? *Educational Psychology Review*, *24*(1), 113-131. doi: 10.1007/10648-011-9183-6

Greer, D. L., Crutchfield, S. A., & Woods, K. L. (2013). Cognitive theory of multimedia learning, instructional design principles, and students with learning disabilities in computer-based and online learning environments. *Journal of Education*, *193*(2). doi: 10.11772F002205741319300205

Hassan, D. A. E. H. (2015). The relationship between attention deficit and hyperactivity disorder ADHD and learning disabilities. *International Journal of Scientific Research in Science and Technology,* 1(4), 197-202. Retrieved from https://www.researchgate.net.

Hesamian, G. (2016). One-way ANOVA based on interval information. *International Journal of Systems Science*, *47*(11), 2682-2690. doi: 10.1080/00207721.2015.1014449

Hollender, N., Hofmann, C., Deneke, M., & Schmitz, B. (2010). Integrating cognitive load theory and concepts of human–computer interaction. *Computers in Human Behavior*, *26*(6), 1278-1288. doi: 10.1016/j.chb.2010.05.031

Institute of Education Sciences. (2013). Reading mastery. Retrieved from http://ies.ed.gov/ncee/wwc/Docs/InterventionReports/wwc_readingmaster.pdf

Jacquez, F., Vaughn, L. M., & Wagner, E. (2013). Youth as partners, participants or passive recipients: A review of children and adolescents in community□based participatory research (CBPR). *American Journal of Community Psychology*, *51*(1-2), 176-189. doi: 10.1007/s10464-012-9533-7

Jitendra, A. K., & Gajria, M. (2011). Reading comprehension instruction for students with learning disabilities. *Focus on Exceptional Children*, *43*(8), 1-16. Retrieved from https://search.proquest.com.

Kaldenberg, E. R., Watt, S. J., & Therrien, W. J. (2015). Reading instruction in science for students with learning disabilities: A meta-analysis. *Learning Disability Quarterly*, *38*(3), 160-173. doi: 10.11772F0731948714550204

Kelly, D., Nord, C. W., Jenkins, F., Chan, J. Y., & Kastberg, D. (2013). Performance of US 15-year-old students in mathematics, science, and reading literacy in an international context. First look at PISA 2012. NCES 2014-024. *National Bureau of Economic Research*.

Kerlinger, F. N. (1986) Foundations of behavioral research. 3rd Edition, Holt, Rinehart and Winston, New York.

Kim, W., Linan-Thompson, S., & Misquitta, R. (2013). Critical factors in reading comprehension instruction for students with learning disabilities: A research synthesis. *Learning Disabilities Research & Practice, 27*(2), 66-78. doi: 10.1111/j.1540-5826.2012.00352

Kuyatt, A., Holland, G., & Jones, D. (2015). An analysis of teacher effectiveness related to technology implementation in Texas secondary schools. *Contemporary Issues in Education Research, 8*(1), 63 – 70. doi: 10.19030/cier.v8i1.9091

Laerd Statistics (2013). One-way ANOVA in SPSS statistics. Retrieved from https://statistics.laerd.com/spss-tutorials/one-way-anova-using-spss-statistics.php.

Lan, Y. C., Lo, Y. L., & Hsu, Y. S. (2014). The effects of meta-cognitive instruction on students' reading comprehension in computerized reading contexts: A quantitative meta-analysis. *Educational Technology & Society*, *17*(4), 186-202. Retrieved from http://www.jstor.org/stable/jeductechsoci.17.4.186

Lenhard, W., Baier, H., Endlich, D., Schneider, W., & Hoffmann, J. (2013). Rethinking strategy instruction: direct reading strategy instruction versus computer‐based guided practice. *Journal of Research in Reading*, *36*(2), 223-240. doi: 10.1111/j.1467-9817.2011.01505

Lodico, M. G., Spaulding, D. T., & Voegtle, K. H. (2010). *Methods in educational research: From theory to practice*. San Francisco, CA: Jossey-Bass.

Loosli, S. V., Buschkuehl, M., Perrig, W. J., & Jaeggi, S. M. (2012). Working memory training improves reading processes in typically developing children. *Child Neuropsychology*, *18*(1), 62-78. doi: 10.1080/09297049.2011.575772

Lykken, A., Wakeman, J., Neyman, J., McLaughlin, T., & Zumwalt, K. (2014). Effects of employing the text, SRA decoding strategies on the word recognition for a high school student with learning disabilities. *i-Manager's Journal on Educational Psychology*, *7*(4), 19. Retrieved from http://www.apa.org/pubs/journals/edu/index.aspx

Marchand-Martella, N. E., Martella, R. C., & Przychodzin-Havis, A. M. (2005). The research base and validation of SRAs Corrective Reading program. DeSoto, TX: SRA/McGraw-Hill.

Mersand, S. (2015). 2015 Reading assessment programs. *Technology & Learning, 35*(8), n.p. Retrieved from https://www.questia.com/read/1G1-412555363/2015-reading-assessment-programs.

McCray, A. D., Vaughn, S., & LaVonne, I. N. (2001). Not all students learn to read by third grade middle school students speak out about their reading disabilities. *The Journal of Special Education*, *35*(1), 17-30. doi: 10.11772F002246690103500103

McMaster, K. L., Espin, C. A., & Broek, P. (2014). Making connections: Linking cognitive psychology and intervention research to improve comprehension of struggling readers. *Learning Disabilities Research & Practice*, *29*(1), 17-24. doi: 10.1111/ldrp.12026

Moats, L. C., & Lyon, G. R. (1993). Learning disabilities in the United States advocacy, science, and the future of the field. *Journal of Learning Disabilities*, *26*(5), 282-294. doi: 10.11772F002221949302600501

Moreau, L. K. (2014). Who's really struggling?: Middle school teachers' perceptions of struggling readers. *Research in Middle Level Education Online*, *37*(10), 1-17. doi: 10.1080/19404476.2014.11462113

National Center for Education Statistics. (2015). *The Nations Report Card: 2015 mathematics & reading assessments.* Retrieved from https://www.nationsreportcard.gov/reading_math_2015/

National Institute of Child Health and Human Development. (2013). *Reading difficulty*

and disability. Retrieved from https://report.nih.gov/nihfactsheets/

O'Connor, R. E., Beach, K. D., Sanchez, V. M., Bocian, K. M., & Flynn, L. J. (2015). Building BRIDGES: A design experiment to improve reading and United States history knowledge of poor readers in eighth grade. *Exceptional Children*, *81*(4), 399-425. doi: 10.11772F0014402914563706

Paas, F., Van Gog, T., & Sweller, J. (2010). Cognitive load theory: New conceptualizations, specifications, and integrated research perspectives. *Educational Psychology Review*, *22*(2), 115-121. doi: 10.1007/10648-010-9133-8

Palladino, P., & Ferrari, M. (2013). Interference control in working memory: Comparing groups of children with atypical development. *Child Neuropsychology*, *19*(1), 37-54. doi: 10.1080/09297049.2011.633505

Paratore, J. R., O'Brien, L. M., Jimenez, L., Salinas, A., & Ly, C. (2016). Engaging preservice teachers in integrated study and use of educational media and technology in teaching reading. *Teaching and Teacher Education, 59*, 247-260. doi: 10.1016/j.tate.2016.06.003

Parker, C. A., Holland, G., & Jones, D. (2013, March). The effectiveness of two reading intervention programs in a South Texas urban school district. *National Forum of Applied Educational Research Journal, 26*(3), 1-9. Retrieved from http://www.nationalforum.com/

Peterson, P. E., & Ackerman, M. (2015). States raise proficiency standards in math and reading. *Education Next*, *15*(3), 1-7. Retrieved from https://www.questia.com/library/p323/education-next

Picciano, A. G., Seaman, J., Shea, P., & Swan, K. (2012). Examining the extent and nature of online learning in American K-12 education: The research initiatives of the Alfred P. Sloan Foundation. *The Internet and Higher Education*, *15*(2), 127-135. doi:10.1016/j.iheduc.2011.07.004

Proctor, C. P., Daley, S., Louick, R., Leider, C. M., & Gardner, G. L. (2014). How motivation and engagement predict reading comprehension among native English-speaking and English-learning middle school students with disabilities in a remedial reading curriculum. *Learning and Individual Differences*, *36*, 76-83. doi: 10.1016/j.lindif.2014.10.014

Reinke, W. M., Stormont, M., Herman, K. C., & Newcomer, L. (2014). Using coaching to support teacher implementation of classroom-based interventions. *Journal of Behavioral Education*, *23*(1), 150-167. doi: 10.1007/s10864-013-9186-0

Roskos, K., & Neuman, S. B. (2014). Best practices in reading. *The Reading Teacher*, *67*(7), 507-511. doi: 10.1002/trtr.1248

Rumrill, P. D., Cook, B. G., & Wiley, A. L. (2011). *Research in special education: Designs, methods, and applications*. Springfield, Illinois: Charles C. Thomas.

Saine, N. L., Lerkkanen, M. K., Ahonen, T., Tolvanen, A., & Lyytinen, H. (2011). Computer-assisted remedial reading intervention for school beginners at risk for reading disability. *Child Development*, *82*(3), 1013-1028. doi: 10.1111/j.1467-8624.2011.01580

Schnotz, W., & Kürschner, C. (2007). A reconsideration of cognitive load theory.

Educational Psychology Review, *19*(4), 469-508. doi: 10.1007/10648-007-9053-4

Scholastic. (2014). SRI Technical Guide. Retrieved from https://www.hmhco.com/products/.

Shannag, Q. A., Tairab, H., Dodeen, H., & Abdel-Fattah, F. (2013). Linking teachers' quality and student achievement in the kingdom of Saudi Arabia and Singapore: The impact of teachers' background and variables on student achievement. *Journal of Baltic Science Education, 12*(5), 652-665. Retrieved from https://www.researchgate.net/profile/Faisal_Abdelfattah/publication/259728833

Shippen, M. E., Houchins, D. E., Steventon, C. & Sartor, D. (2005). A comparison of two direct instruction reading programs for urban middle school students. *Remedial and Special Education, 26*(3), 175-182. doi: 10.11772F07419325050260030501

Simon, M. K., & Goes, J. (2013). Ex post facto research. *Dissertation and Scholarly Research: Recipes for Success*. Retrieved September 25, 2013.

Sleeter, C. (2010). Why is there learning disabilities? A critical analysis of the birth of the field in its social context. *Disability Studies Quarterly*, *30*(2), 210-237. doi: 10.18061/dsq.v30i2.1261

Solis, M., Miciak, J., Vaughn, S., & Fletcher, J. M. (2014). Why intensive interventions matter longitudinal studies of adolescents with reading disabilities and poor reading comprehension. *Learning Disability Quarterly*, *37*(4), 218-229. doi: 10.11772F0731948714528806

Spencer, S. A., & Manis, F. R. (2010). The effects of a fluency intervention program on the fluency and comprehension outcomes of middle-school students with severe reading deficits. *Learning Disabilities Research & Practice, 25*(2), 76 – 86. doi: 10.1111/j.1540-5826.2010.00305

Spencer, M., Quinn, J. M., & Wagner, R. K. (2014). Specific reading comprehension disability: Major problem, myth, or misnomer? *Learning Disabilities Research & Practice*, *29*(1), 3-9. doi: 10.1111/ldrp.12024

Steventon, C. E., & Fredrick, L. D. (2003). The effects of repeated readings on student performance in the corrective reading program. *Journal of Direct Instruction*, *3*(1), 17-27. Retrieved from https://www.nifdi.org/research/journal-of-di

Stockard, J. (2010). Promoting reading achievement and countering the fourth-grade slump: The impact of direct instruction on reading achievement in fifth grade. *Journal of Education for Students Placed at Risk*, *15*(3), 218-240. doi: 10.1080/10824669.2010.495687

Swanson, E., Wanzek, J., Vaughn, S., Roberts, G., & Fall, A. M. (2015). Improving reading comprehension and social studies knowledge among middle school students with disabilities. *Exceptional Children*, *81*(4), 426 - 442. doi: 10.11772F0014402914563704

Taboada, A., & Buehl, M. M. (2012). Teachers' conceptions of reading comprehension and motivation to read. *Teachers and Teaching*, *18*(1), 101-122. Doi: 10.1080/13540602.2011.622559

van de Werfhorst, H. G. (2014). Changing societies and four tasks of schooling: Challenges for strongly differentiated educational systems. *International Review of Education*, *60*(1), 123-144. doi: 10.1007/s11159-014-9410-8

Vaughn, S., & Wanzek, J. (2014). Intensive interventions in reading for students with reading disabilities: Meaningful impacts. *Learning Disabilities Research & Practice*, *29*(2), 46-53. doi: 10.1111/ldrp.12031

Washburn, E. K., Joshi, R., & Binks□Cantrell, E. S. (2011). Teacher knowledge of basic language concepts and dyslexia. *Dyslexia*, *17*(2), 165-183. doi: 10.1002/dys.426

Watson, S. R., Gable, R. A., Gear, S. B., & Hughes, K. C. (2012). Evidence-based strategies for improving the reading comprehension of secondary students: Implications for students with learning disabilities. *Learning Disabilities Research & Practice*, *27*(2), 79-89. doi: 10.1111/j.1540-5826.2012.00353

Williams, C. (2011). Research methods. *Journal of Business & Economics Research*, *5*(3), 65 - 72. Retrieved from https://www.springer.com/business&management/journal

Williams, J. P., Kao, J. C., Pao, L. S., Ordynans, J. G., Atkins, J. G., Cheng, R., & DeBonis, D. (2016). Close analysis of texts with structure (CATS): An intervention to teach reading comprehension to at-risk second graders. *Journal of Educational Psychology, 108*(8), 1061- 1079. doi: 10.1037/edu0000117

Wong, A., Leahy, W., Marcus, N., & Sweller, J. (2012). Cognitive load theory, the transient information effect and e-learning. *Learning and Instruction*, *22*(6), 449-

457. doi: 10.1016/j.learninstruc.2012.05.00

Worrell, J., Duffy, M. L., Brady, M. P., Dukes, C., & Gonzalez-DeHass, A. (2016). Training and generalization effects of a reading comprehension learning strategy on computer and paper-pencil assessments. *Preventing School Failure: Alternative Education for Children and Youth, 60*(4), 267-277. doi: 10.1080/1045988X.2015.1116430

Yakimowski, M. E., Faggella-Luby, M., Kim, Y., & Wei, Y. (2016). Reading achievement in the middle school years: A study investigating growth patterns by high incidence disability, *Journal of Education for Students Placed at Risk,* 21(2), 118-128. doi: 10.1080/10824669.2016.1147962

Yilmaz, K. (2011). The cognitive perspective on learning: Its theoretical underpinnings and implications for classroom practices. *The Clearing House: A Journal of Educational Strategies, Issues and Ideas*, *84*(5), 204-212. doi: 10.1080/00098655.2011.568989

Young, J. Q., Van Merrienboer, J., Durning, S., & Cate, O. (2014). Cognitive load theory: Implications for medical education: AMEE guide no. 86. *Medical teacher*, *36*(5), 371-384. doi: 10.3109/0142159X.2014.889290

Yurt, E., & Tünkler, V. (2016). A Study on the spatial abilities of prospective social studies teachers: A mixed method research. *Educational Sciences: Theory & Practice, 16*, 965-986. doi: 10.12738/estp.2016.3.0324