EFFECTS OF SUPPLEMENTAL MULTISENSORY INSTRUCTION CORRELATED WITH A BASAL READING PROGRAM ON FIRST GRADERS' DECODING, ENCODING, AND ORAL READING FLUENCY SKILLS

by

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ABSTRACT

This quantitative study purposed to determine whether and to what extent the decoding, encoding and oral reading fluency skills of first grade students in a Bob Jones Academy reading program were affected depending upon one of two treatments of classroom instruction received: (1) classroom reading program with no supplemental reinforcement, (2) classroom reading program supplemented with multisensory methods taught by the researcher with additional classroom teacher reinforcement. These students were evaluated using a combination of researcher-created and professionally-developed pretests and posttests to examine differences in achievement between the two groups in decoding skills, which were measured by word attack (nonsense words) and word identification (real words) subtests, as well as encoding and oral reading fluency skills.

The multisensory instruction was correlated with the school's basal reading curriculum by following the same order in which phonics skills were presented as listed in the scope and sequence. The study included 63 first grade participants, which were divided into two treatment group classes and two control group classes. Independent t-tests were used to analyze the data. Improvement scores revealed statistically significant results on all decoding and encoding subtests favoring the entire population of the treatment group. Although oral reading fluency improvement scores were not statistically significant, the treatment group mean scores were greater than the control group mean score

Improvement scores from the treatment group students within the bottom and top 50^{th} percentile revealed statistically significant gains in the word identification subtest. Treatment group students within the bottom 50^{th} percentile also revealed statistically significant gains in the word attack test and encoding (words spelled correctly) subtest..

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INTRODUCTION

Virtually every elementary school teacher who has been teaching reading for any length of time understands the challenge that presents itself when called upon to instruct twenty or more children with varying degrees of reading readiness skills, intellectual abilities and learning styles. The necessity of engaging and effectively teaching reading to a population of students with such diverse abilities and experiences creates a tremendously difficult task for these teachers. In many typical reading classrooms, students are divided into reading groups according to ability in order to better individualize the content and pace of instruction for the students. These groups work through a series of basal readers with connected phonics activities throughout the year. This scenario presents the problem of how to handle those in the lower reading groups that need more time than their counterparts to process the related phonics skills. In many cases within the younger grades, the struggling readers in the *lowest* group have difficulty even reading the simplest words within the basal readers. So the question that must be answered is how the teacher maintains pace amongst these groups so that all students can achieve core content by the end of the year.

One option is for the teacher to slow down instruction for this lowest group and take the risk that all grade level core content may not be covered for these students who are already struggling to read. A second option is for the teacher to skip stories in the basal readers for this group in order to reach end of year objectives, despite the fact that readability and sight vocabulary are built up story by story. This scenario, however, is likely to create frustration on the part of the student because he or she has not learned the necessary skills to keep up. A third option is to periodically remove these children from the regular classroom and provide more individualized, small group reading instruction in a separate classroom. The difficulty with this option is that if a different curriculum is being used during this time, it may not be covering the same skills at the same time as the regular classroom. An alternative, and possibly more effective, solution to these issues may be to present new phonics skills to all classroom students at the same time, using systematic, multisensory methods, and directly correlate the introduction of these skills with the existing curriculum. Doing so may well enable those students who learn best with a kinesthetic/tactile approach to better grasp the phonics concepts when they are initially being taught, with the goal that they will be able to stay on pace with the rest of the classroom without the teacher having to slow down or skip stories with these students. The purpose of this study then was to explore the effects of supplementing the traditional classroom reading and phonics curriculum with additional multisensory instructional methods and to measure the impact this had on student reading outcomes.

Spiritual Significance

The ability to read and learn is a gift from God. God chose to use written symbols to guide His people into a greater understanding of Himself and to preserve His Word. Hebrews 4:12 describes God's Word as "…living and active, sharper than any two-edged sword, piercing to the division of soul and of spirit, of joints and of marrow, and discerning the thoughts and intentions of the heart" (*English Standard Version*). God's written Word also provides His people with an understanding of His expectations. While preparing for the temple repair during the reign of Josiah, the high priest Hilkiah found the Book of the Law and read it to the king:

> When the king heard the words of the Book of the Law, he tore his clothes…go, inquire of the Lord for me, and for the people, and for all Judah, concerning the words of this book that has been found. For great is the wrath of the Lord that is kindled against us, because our fathers have not obeyed the words of this book, to do according to all that is written concerning us. (II Kings 22:11, 13)

It was through the reading of this Book of the Law that King Josiah and his people saw their sin as God saw it.

The original purpose of education in our own country, when it formally began in Puritan New England, was to teach children to read the Bible in order to gain an understanding of salvation and learn how to live a life that pleased God (Gelbrich, 1999; Adams, 1990). In 1647, for example, Massachusetts passed one of the earliest compulsory education laws, known as "The Old Deluder Satan Act." The Act required Puritan colonies with more than 50 households to appoint someone to teach children within the colony to read and write. The Act got its name from its first line wherein its purpose is stated: "it being one chief project of that old deluder, Satan, to keep men from the knowledge of the Scriptures . . ." (ca. 1853, p. 1). The colonists' goal in creating a literate society was to defeat Satan, who had used illiteracy in the old world to keep people from reading the Word of God. Literacy is truly the only way a person can read and determine for himself what the Scriptures say, and is thus a fundamental need for every human being who desires to know and understand God's Word (ca. 1853).

State of the Nation

In 2013, a staggering 32% of fourth grade public school students in the United States scored below a *Basic* reading level on the national reading assessment (National Center for Education Statistics [NCES], 2013). To achieve a *Basic* reading score on this assessment a student must, with respect to word knowledge, have a "partial mastery of prerequisite knowledge and skills that are fundamental for proficient work at each grade level." (NCES, 2012, p. 1). This means that one-third of the middle-elementary school student population in the United States has inadequate reading skills expected for their grade level. In a discussion of reading instruction inadequacies, Bhat, Rapport, and Griffin (2000) reported that

> [w]hile basal reading programs are used widely by teachers in public schools, multisensory experiences, direct instruction, and the development of alphabetic reading skills may not be a part of the instructional methods included in these programs. . . . [This has] led a group of parents of students . . . to question the appropriateness of programs and methods used by schools to teach their children to read . . . particularly . . .for students who have not made adequate progress in school. (p. 283)

Because of the large percentage of students that struggle to read, it is imperative that young struggling readers be identified and remediated as early as possible.

Introducing phonics and related skills to beginning readers in ways that will strengthen understanding from the very beginning of their reading experiences may help reduce the number of children who struggle and need such remediation.

General Description of Multisensory Education

A multisensory approach to learning is one in which multiple methods of instruction are employed in an effort to help create and reinforce brain pathways so as to solidify understanding of the concepts being taught. Multisensory approaches to learning entail the use of these (VAKT) senses during instruction. The objective in this process is to create links between these sensory pathways in order to maximize a child's learning potential.

History of Multisensory Methods

Students entering the classroom are increasingly diverse in their ethnicity, cultural backgrounds, school readiness abilities, home environments, and other factors that contribute to their learning abilities. This diversity impacts the classroom in that a broad array of learning styles is represented. Given this, the potential benefit from a multisensory approach to reading in the classroom is greater than ever. The use of multisensory teaching techniques is by no means a new concept, however. The master teacher, Jesus Christ, used various multisensory methods for communicating truths to those around Him. Jesus used the kinesthetic-tactile method of teaching when He used His own saliva to create clay from dirt to heal a blind man (John 9:1-6). Jesus could easily just have spoken words of healing, yet He added in these other sensory components as He illustrated to His disciples that the man's disability was not due to his or his parents' sins, but was rather given to him as an opportunity for God's glory to be manifested.

Peter probably had the most memorable kinesthetic-tactile lesson in the Bible when he jumped from his boat into a raging storm and walked on water towards Jesus. Matthew 14: 30, 31 says

> But when he saw the wind, he was afraid, and beginning to sink he cried out, 'Lord, save me.' Jesus immediately reached out his hand and took hold of him, saying to him, 'O you of little faith, why did you doubt?'

Jesus used that experience as an illustration of the power He gives His children to rise above their circumstances (e.g., billowing waves) and sustain focus on Him. In another setting, Jesus used a coin as a visual illustration to the Pharisees when they asked, "Is it lawful to pay taxes to Caesar, or not? Should we pay them, or should we not?" Instructing them to bring Him the coin, Jesus pointed out Caesar's face on the coin and told them, "Render to Caesar the things that are Caesar's, and to God the things that are God's" (Mark 12:14-17). Jesus also employed the auditory senses as He delivered sermons to the multitudes on a number of occasions (Matt. 5-7. Luke 5: 1-3; Matt 9:35). In one instance He preached to the people from a mountaintop. The Scriptures declare, "He opened his mouth and taught them saying . . ." (Matt. 5:2). Jesus used this particular sermon, the "Sermon on the Mount," to verbally describe how His followers should live.

Within the academic context, the development of multisensory instruction is most notably attributed to Samuel Orton, a neurologist, during the twentieth century (Bates, 2013). Orton worked with stroke victims and sought to determine the areas of the brain that had been affected by the stroke. During his work, he encountered a young girl who was unable to read and had similar difficulties to those experienced by his stroke patients, despite the fact that she had not had a stroke and there was no notable brain damage causing these difficulties. This young girl's deficiencies piqued Orton's curiosity about the underlying causes of reading difficulties and their relationship to brain function (Orton, 1925). As a result of his research, Orton developed a theory called *strephosymbolia* (also called "twisted symbols"), which described as *dyslexic* those persons who had difficulty making the connection between letters and their associated sounds (McClelland, 1989). He discovered that many children with reading difficulties had average or above average IQ scores. Further investigation led him to conclude that the potential root cause of these reading difficulties was the person's decreased ability to access the left hemisphere of the brain when reading (Dahl, 2011), which is the primary hemisphere where the process of reading takes place (Shaywitz & Shaywitz, 2007; Pugh et al, 2013). In light of this belief, he sought to teach children how to read by means of accessing both the left and the right parts of the brain through a variety of learning modalities during instruction (Campbell, 2004).

Orton worked with psychologist and educator, Anna Gillingham, to develop what is considered the first multisensory language instruction curriculum (Ritchey & Goeke, 2006; Campbell, 2004). The curriculum was based on the idea that letter-sound associations could be reinforced by adding in a kinesthetic-tactile component in conjunction with other physiological senses (i.e., visual and auditory) during instruction, which could "correct the tendency of confusing similar letters and transposing the sequence of letters while reading and writing" (International Dyslexia Association [IDA], 2009, p. 2). The phrase *Orton-Gillingham approach* refers to the "structured, sequential, multisensory techniques established by Doctor Orton, Miss Gillingham, and their colleagues" (IDA, 2009, p. 2). This idea of disseminating language instruction with the addition of a kinesthetic mode thus became the backbone of multisensory instruction (IDA, 2009).

Statement of the Problem

According to Petrilli (2011) "the greatest challenge facing America's schools today . . . is the enormous variation in the academic level of students coming into any given classroom" (p. 1). Of particular importance is the necessity of meeting the academic needs of the struggling readers without sacrificing their core reading content (Woodward & Talbert-Johnson, 2009). As a result, varying approaches to multisensory structured language instruction have been developed for the purpose of meeting these students' needs (International Dyslexia Association [IDA], 2009).

The purpose of this study was to determine whether and to what extent the decoding, encoding and oral reading fluency skills of first grade students using the Bob Jones Press basal reading program were affected depending upon one of two treatments of classroom instruction received: (1) classroom reading program with no supplemental reinforcement, (2) classroom reading program supplemented with multisensory methods taught by the researcher with additional classroom teacher reinforcement. These students were evaluated using a combination of researcher-created and professionally-developed pretests and posttests in order to examine differences in achievement between the two groups in decoding, encoding and oral reading fluency skills. The decoding word attack subtests measured the total phonemes (sounds) within each word that were pronounced correctly until the student reached a ceiling by incorrectly decoding five consecutive words (Woodcock, 2011; Brigance, 1999). The decoding word identification subtests measured the amount of words read correctly within a one-minute time frame (Good & Kaminski, 2002). The encoding subtests measured correct letter-sound association (called "phonics points" on the subtests) and correct spelling of words (Bear, Invernizzi, Templeton, & Johnston, 2008). The students' oral reading fluency was assessed by averaging the amount of correct words read within three connected word passages during a one-minute timed sample (Good & Kaminski, 2002).

Statement of Research Questions

This study attempted to answer the following questions related to the inclusion of supplemental multisensory instruction correlated with the classroom basal reading curriculum:

1. Does supplemental multisensory instruction improve overall student performance in decoding, encoding and oral reading fluency of first grade students as measured by a pretest and posttest?
2. Does supplemental multisensory instruction improve performance in decoding, encoding and oral reading fluency of first grade students in the bottom 50th percentile of total reading scores on the Stanford Achievement Test within the BJA first grade as measured by a pretest and posttest?

3. Does supplemental multisensory instruction improve performance in decoding, encoding and oral reading fluency of first grade students in the top 50th percentile of total reading scores on the Stanford Achievement Test within the BJA first grade as measured by a pretest and posttest?

Null Hypotheses

Ho1: Among all first grade students, there is no significant difference in the improvement scores on the decoding word identification (real word) subtest, as measured by the pretest and posttest, between those students receiving classroom reading instruction only (control group) and those receiving classroom instruction supplemented with multisensory methods taught by the researcher and reinforced by the classroom teacher (treatment group).

Ho2: Among all first grade students, there is no significant difference in the improvement scores on the decoding word attack (nonsense word) subtest, as measured by the pretest and posttest, between those students receiving classroom reading instruction only (control group) and those receiving classroom instruction supplemented with multisensory methods taught by the researcher and reinforced by the classroom teacher (treatment group).

Ho3: Among all first grade students, there is no significant difference in the improvement scores of words spelled correctly on the encoding subtest, as measured by the pretest and posttest, between those students receiving classroom reading instruction only (control group) and those receiving classroom instruction supplemented with multisensory methods taught by the researcher and reinforced by the classroom teacher (treatment group).

Ho4: Among all first grade students, there is no significant difference in the improvement scores of phonics points on the encoding subtest, as measured by the pretest and posttest, between those students receiving classroom reading instruction only (control group) and those receiving classroom instruction supplemented with multisensory methods taught by the researcher and reinforced by the classroom teacher (treatment group).

Ho5: Among all first grade students, there is no significant difference in the improvement scores on the DIBELS Oral Reading Fluency subtest, as measured by the pretest and posttest, between those students receiving classroom reading instruction only (control group) and those receiving classroom instruction supplemented with multisensory methods taught by the researcher and reinforced by the classroom teacher (treatment group).

Ho6: Among the bottom 50th percentile of students, relative to their peers, within each BJA first grade class on the Stanford Achievement Test total reading scores, there is no significant difference in the improvement scores on the decoding word identification (real word) subtest, as measured by the pretest and posttest, between those first grade students receiving classroom reading instruction only (control group) and first grade students receiving classroom instruction supplemented with multisensory methods taught by the researcher and reinforced by the classroom teacher (treatment group).

Ho7: Among the bottom 50th percentile of students, relative to their peers, within each BJA first grade class on the Stanford Achievement Test total reading scores, there is no significant difference in the improvement scores on the decoding word attack (nonsense word) subtest, as measured by the pretest and posttest, between those first grade students receiving classroom reading instruction only (control group) and first grade students receiving classroom instruction supplemented with multisensory methods taught by the researcher and reinforced by the classroom teacher (treatment group).

Ho8: Among the bottom 50th percentile of students, relative to their peers, within each BJA first grade class on the Stanford Achievement Test total reading scores, there is no significant difference in the improvement scores of words spelled correctly on the encoding subtest, as measured by the pretest and posttest, between those first grade students receiving classroom reading instruction only (control group) and first grade students receiving classroom instruction supplemented with multisensory methods taught by the researcher and reinforced by the classroom teacher (treatment group).

Ho9: Among the bottom 50th percentile of students, relative to their peers, within each BJA first grade class on the Stanford Achievement Test total reading scores, there is no significant difference in the improvement scores of phonics points on the encoding subtest, as measured by the pretest and posttest, between those first grade students receiving classroom reading instruction only (control group) and first grade students receiving classroom instruction supplemented with multisensory methods taught by the researcher and reinforced by the classroom teacher (treatment group).

Ho10: Among the bottom 50th percentile of students, relative to their peers, within each BJA first grade class on the Stanford Achievement Test total reading scores, there is no significant difference in the improvement scores on the DIBELS Oral Reading Fluency subtest, as measured by the pretest and posttest, between those first grade students receiving classroom reading instruction only (control group) and first grade students receiving classroom instruction supplemented with multisensory methods taught by the researcher and reinforced by the classroom teacher (treatment group).

Ho11: Among the top 50th percentile of students, relative to their peers, within each BJA first grade class on the Stanford Achievement Test total reading scores, there is no significant difference in the improvement scores on the decoding word identification (real word) subtest, as measured by the pretest and posttest, between those first grade students receiving classroom reading instruction only (control group) and first grade students receiving classroom instruction supplemented with multisensory methods taught by the researcher and reinforced by the classroom teacher (treatment group).

Ho12: Among the top 50th percentile of students, relative to their peers, within each BJA first grade class on the Stanford Achievement Test total reading scores, there is no significant difference in the improvement scores on the decoding word attack (nonsense word) subtest, as measured by the pretest and posttest, between those first grade students receiving classroom reading instruction only (control group) and first grade students receiving classroom instruction supplemented with multisensory methods taught by the researcher and reinforced by the classroom teacher (treatment group).

Ho13: Among the top 50th percentile of students, relative to their peers, within each BJA first grade class on the Stanford Achievement Test total reading scores, there is no significant difference in the improvement scores of words spelled correctly on the encoding subtest, as measured by the pretest and posttest, between those first grade students receiving classroom reading instruction only (control group) and first grade students receiving classroom instruction supplemented with multisensory methods taught by the researcher and reinforced by the classroom teacher (treatment group).

Ho14: Among the top 50th percentile of students, relative to their peers, within each BJA first grade class on the Stanford Achievement Test total reading scores, there is no significant difference in the improvement scores of phonics points on the encoding subtest, as measured by the pretest and posttest, between those first grade students receiving classroom reading instruction only (control group) and first grade students receiving classroom instruction supplemented with multisensory methods taught by the researcher and reinforced by the classroom teacher (treatment group).

Ho15: Among the top 50th percentile of students, relative to their peers, within each BJA first grade class on the Stanford Achievement Test total reading scores, there is no significant difference in the improvement scores on the DIBELS Oral Reading Fluency subtest, as measured by the pretest and posttest, between those first grade students receiving classroom reading instruction only (control group) and first grade students receiving classroom instruction supplemented with multisensory methods taught by the researcher and reinforced by the classroom teacher (treatment group).

Assumptions

An assumption is defined by *The Merriam-Webster Dictionary* as "a fact or statement (as a proposition, axiom, postulate, or notion) taken for granted" (2013, expression 5). The researcher accepted the following assumptions:

1. The provision of systematic, explicit phonics instruction related to basal readers improved decoding skills in connected text.
2. Confidentiality of individual student scores and records were protected throughout the study.
3. First grade students involved in this study reflected the general population of first grade students within Christian schools commensurate to age and cognitive levels.
4. The students appropriately demonstrated their knowledge of decoding, as measured by word identification (real word) and word attack (nonsense word) subtests, encoding, and oral reading fluency skills on the pretest and posttest assessments.

Delimitations

This study included the following uncontrollable variables, which may limit the value of the experimental results:

1. The amount of time given for teaching additional multisensory methods to the treatment groups was limited to approximately half of the time requested by researcher.
2. The research design used intact classes; therefore, the sample population is not randomly selected.

3. The demographics (excluding age and cognitive level variables) of the participating school may be different than other school demographics; therefore, generalizations can only be made to similar populations.
4. The delayed start of the study caused a reduction in some of the phonics skills that were able to be introduced and reinforced with multisensory methods.

Definition of Terms

1. Basal readers: grade-leveled series of reading textbooks in which the stories incorporate phonics skills and other reading-related skills. Often termed scientifically-based reading programs, these readers are structured and cumulative in their progression of difficulty levels.
2. Decoding: the ability to recognize a letter and identify the appropriate sound that it makes
3. Dyslexia: "a specific learning disability that is neurobiological in origin. It is characterized by difficulties with accurate and/or fluent word recognition and by poor spelling and decoding abilities" (Lyon, Shaywitz, & Shaywitz, 2003, p. 2).
4. Encoding: the ability to hear a sound and identify the appropriate letter that matches the sound
5. Grapheme: the visual symbol (letter) used to represent the phoneme (sound)
6. Kinesthetic-tactile learning: a learning style that uses hands-on methods. For the purpose of this study, this will include tapping fingers as words are sounded out, finger-writing word spellings on the desk, a gel board, or in the air, and manipulation of letters tiles on magnetic boards

7. Multisensory structured reading approach: combines the use of VAKT (visual, auditory, kinesthetic-tactile) senses during reading instruction. Learning involves a direct and explicit approach that is "cumulative, intensive, and focused on the structure of language" (IDA, 2009, p. 1).
8. Nonsense words: Also referred to as "pseudowords" or "red words," these are decodable words with no commonly-understood meaning. These words will be tested on the decoding word attack subtests.
9. Orton-Gillingham approach: a multisensory approach to teaching reading and spelling that can be used with individual or group instruction. This method is derived from "Doctor Orton, Ms. Gillingham, and their colleagues" (IDA, 2009, p.2) and involves "auditory, visual, and kinesthetic elements reinforcing one another, targeting persons with the kinds of language processing problems (reading, spelling, and writing) associated with dyslexia" (What Works Clearinghouse [WWC] 2010, p. 1).
10. Phonemic awareness: the ability to comprehend phonemes, which are the smallest units of sound
11. Phoneme: the smallest unit of sound in a word. For example, the word "cat" is made up of three phonemes (or three sounds): /c/, /a/, /t/ (Wiig & Menyuk, 2004).
12. Phonological awareness: the study of speech structure within a language, including both the patterns of basic speech units and the accepted rules of pronunciation (National Reading Panel [NRP], 2000)

13. Reading comprehension: the connection between a reader's own background schema to what is being read and the level to which it is fully understood (Learning Point Associates [LPA], 2004)

14. Reading fluency: the ability to read texts quickly and accurately by grouping words together and gaining meaning from what is read by reading phrase by phrase rather than word by word. Three primary elements of reading fluency are reading rate, reading accuracy, and reading expression (NRP, 2000; Kuhn & Stahl, 2004). For the purposes of this study, reading fluency was measured by a student's oral reading rate.

15. Real words: for the purpose of this study, real words are defined as words with a commonly-understood meaning. These words were tested on the decoding word identification subtest.

16. Semantics: the specific ways in which language creates meaning. This term is "culture-dependent" (Wiig & Menyuk, 2004, p. 42) and moves beyond the literal meaning of the words to an understanding of intended meaning.

17. Sound-symbol correspondence: the relationship between the letter sound(s), phonemes, and their associated visual symbol, graphemes

18. Syntax: "the study of how individual words and their most basic meaningful units are combined to create sentences" (Wiig & Menyuk, 2004, p. 42). In the English language, the study of syntax focuses on word order within sentences. When word order is rearranged, meaning often changes.

19. Systematic and explicit phonics instruction: sound-symbol correspondences are directly taught by the teacher following a prescribed scope and sequence that progressively builds upon foundational concepts (National Reading Panel [NRP], 2002).

Significance of Study

Because young children enter school with such an array of reading readiness abilities and the development of reading acquisition is so crucial at this age, it is imperative that the classroom curriculum contain instructional strategies and assessments that meet the diverse learning needs and abilities of individual students (Richards, Pavri, Golez, Canges, & Murphy, 2007). A strong predictor of reading achievement in young children is the amount of time spent in direct instruction on phonics-related activities. (Adams, 1990; NRP, 2000). Basal reading programs are a popular choice for connecting phonics-related activities to words within stories that are then read aloud by the children (Adams, 1990). Yet, the structure of such a program comes with its set of problems for the teacher with struggling readers. Teachers with students that have low reading readiness often encounter the problem of how to meet the needs of these students and yet maintain a pace that does not cause them to fall further behind their peers. According to Woodward and Talbert-Johnson (2009), the ability to differentiate instruction to meet the needs of all learners without sacrificing core reading content skills necessary for a particular grade level is a constant struggle within the classroom. Supplementing the existing classroom curriculum with additional multisensory instructional strategies and assessments during the introduction and reinforcement of new phonics concepts is a potential solution to this problem.

The significance of this study is in whether, and to what extent those readers who are in the low average to below average range, relative to their peers within the regular classroom, increased their encoding, decoding, and oral reading fluency skills by supplementing traditional classroom reading curriculum with the introduction of multisensory materials and methods being used systematically and consistently along with the classroom reading curriculum. This study also sought to evaluate the extent to which average and above average readers, relative to their peers, improved in their reading abilities due to supplemental multisensory instruction as compared to readers without the intervention. Therefore, the goal of this study was to evaluate whether a multisensory supplement to the existing reading curriculum better supports the different learning styles and reading abilities such that by adding this component, the teacher can adequately cover grade level course objectives for all students using the current classroom curriculum.

Summary

Chapter one presented the primary problem addressed by this study: meeting the needs of diverse learners while using only the core classroom curriculum. The background of the problem and the significance of this study have been explored, along with 15 null hypotheses, assumptions, delimitations and operational definitions. Chapter two examines the literature related to the study. The primary components of reading acquisition as well as factors contributing to children's reading difficulties are explored in depth before the focus of multisensory instruction is discussed. This is done in order to provide a framework of knowledge upon which the research design is built. Chapter three restates the problem being studied, the research questions and the research hypotheses. It also outlines the research design, describes the sample population, explains the test instrument measurements and corresponding data collection and analysis, and summarizes the pilot study. Chapter four restates the problem, research questions, and null hypotheses. The description of the sample population is summarized and the data collection procedures are discussed. Each null hypothesis was tested and briefly analyzed. Chapter five contains a general summary and conclusions for each of the null hypotheses. Implications for the current study and recommendations for further research are discussed.

CHAPTER II

A REVIEW OF THE LITERATURE

In order to present the case for systematic classroom multisensory reading instruction, a review of the literature that examines factors contributing to children's reading difficulties, as well as a discussion of the reading acquisition process, its components, and the factors that influence that process, is necessary. If one has no understanding of the basic elements that contribute to a child's ability to read, then that person has no background upon which to determine whether systematic, consistently applied multisensory methods integrated into the reading curriculum will make any difference in the child's ability to read.

Process of Reading Acquisition

Reading is an essential component of language. It is a written language that represents a spoken language where symbols, representing "linguistic units," are put together in an accepted arrangement in order to communicate a message (Lundberg, 2009). The process of learning to read, or "reading acquisition," is a multifaceted one that includes a variety of cognitive and perceptual elements. The multiple components required for success in this endeavor have been likened to driving a car. In order to drive, one must understand how the different parts of the car work together, such as the steering wheel, gear shifts, gas and brake pedals (Adams, 1990). Likewise, a new reader must grasp the basic components of reading in order to discern meaning from a printed text (Friesen & Butera, 2012).

The development of literacy is a progression from an *implicit* understanding of language, which occurs in verbal communication, to a more *explicit* understanding of language, which occurs in visual communication through reading and writing (Lundberg, 2009). Before a child even encounters print, he is beginning the process of reading acquisition through observation and interaction with verbal and nonverbal language (Gombert, 2003). During early development, children become implicitly aware of how these verbal sounds are put together into a conventional format in order to produce meaning. As the awareness progresses, children develop the ability to apply syntax to speech by correctly grouping words together and by following grammatical rules for language in order to communicate their message in a more proficient manner (Wiig & Menyuk, 2004). The process of reading acquisition thus involves a shift from implicit comprehension of verbal language to explicit comprehension of written language through the printed text (Gombert, 2003).

Critical Components of Reading Acquisition

According to the National Reading Panel, reading acquisition consists of five primary components: phonemic awareness, phonics, vocabulary, fluency, and comprehension (NRP, 2000). Each of these subskills has particular relevance to the development of reading abilities. The following discussion defines these subskills, examines their importance in the flow of reading acquisition, and explains how they relate to each other.

Phonemic Awareness

Phonemic awareness is the ability of the language learner to manipulate the sounds of oral speech and can be taught through blending, segmenting, phoneme addition or deletion in words, or phoneme substitution in words (International Reading Association [IRA], 1998). Phonemic awareness and phonological awareness are often mistakenly used interchangeably; in actuality, phonemic awareness is a subskill of phonological awareness. It is necessary then to differentiate between the two terms and to consider phonemic awareness separately from phonological awareness (Chapman, 2012). *Phonemic awareness* is the ability to comprehend *phonemes*, which are the smallest units of sound (International Reading Association [IRA], 1998). For example, the word “dog” is made up of three phonemes because it has three sounds: /d/, /o/, /g/. The word “ship” is also made up of three phonemes because it also has three sounds, even though it has four letters /sh/, /i/, /p/. The term *grapheme* is the visual symbol used to represent the phoneme. Thus, in the previous example, the sounds (phonemes) /d/, /o/, /g/ are represented by the letters (graphemes) “d”, “o”, “g”. One letter representing one sound creates a sound-to-single-letter correspondence. This contrasts with a sound-to-letter cluster correspondence such as in the word “ship,” where one sound, /sh/, is made up of two letters: “s” and “h” (a letter cluster). (LPA, 2004).

Phonemic awareness is a critical component of reading acquisition because it enables the child to connect the individual sound units to the letters associated within the written word. Hoover (2003) further explains this:

> … any system that links written letters to the phonemes underlying the spoken word requires phonemic awareness, because the would-be learner cannot connect the units underlying the written word (the letters) with the units underlying the spoken word (the phonemes) unless she is consciously aware of both and has the intent to learn the relationship between the two (known as the alphabetic principle). (p. 1)

Many studies have been conducted on the impact of phonemic awareness (PA) on reading acquisition. The National Reading Panel (NRP, 2002) conducted a meta-analysis of 52 studies on phonemic awareness, and concluded that PA instruction is highly effective in helping children develop the ability to read and spell. In their report, *Teaching Children to Read*, the NRP explicitly states “PA training benefits not only word reading but also reading comprehension. PA training contributes to children’s ability to read and spell for months, if not years, after the training has ended” (p. 2-40). In this meta-analysis, the overall effect size on phonemic awareness ability was large (d = 0.86). The overall effect size on reading outcomes was moderate (d = 0.53), and the overall effect on spelling was also moderate (d = 0.59). Interestingly, tests given several months following the intervention revealed statistically significant effects. Effects were also significant on standardized tests as well as experimenter-created tests. Effect sizes were larger when the instruction was explicit and structured with a focus on one (d = 0.71) or two (d = 0.79) PA skills rather than a combination of three (d = 0.27) or more PA skills. The results from this comprehensive analysis showed that instruction with a focus on phonemic awareness improves reading for children across all ranges of reading abilities, grade levels, SES status and ELL status, more than instruction that does not include it.

Phonics

Phonics is considered the print form of the larger skill of phonological awareness and includes specifically an understanding of letter-sound correspondence (Semingson, 2011). Phonological awareness is a general understanding of word structure with an understanding of rhyming, onsets and rimes, alliteration, and syllabication (Cummings, Kaminski, Roland, Good, & O'Neil, 2010). Phonics encapsulates these subskills into a curriculum in order to develop students' abilities in reading, writing, and spelling (Semingson, 2011). According to Popp (2004) "rather than ensuring students master all the rules for decoding words, phonics provides children with an awareness of word structure, and this awareness, in turn, allows them to generalize the rules they have mastered to read new words" (p. 51). According to the NRP (2000), it is the "systematic phonics instruction [which] leads to significant and positive benefits for students in kindergarten through sixth grade and for children with difficulty learning to read" (p. 1).

Phonics is considered an essential component of reading acquisition because it enables readers to make sense of the sequence of sounds in written form through a basic understanding of the alphabetic principle (Foy & Mann, 2006; Allor, 2002; Anthony et al, 2006). In other words, it is an understanding of the sound-to-letter(s) correspondence (sometimes referred to as sound-to-symbol correspondence or grapheme-phoneme relationship) that communicates a message to the reader (IRA, 1998). The stronger these sound-to-letter connections are, the more proficient the reading becomes (LPA, 2004).

Teaching phonics in a *systematic* manner means that phonics rules are taught in an increasingly complex developmental progression so that the child is building upon previous skills as he continues through the program rather than being introduced to random rules as they appear. The National Reading Panel (NRP, 2000) conducted a meta-analysis of thirty-eight studies with 66 treatment-control group comparisons to determine the effectiveness of phonics instruction in early reading acquisition. The results showed that systematic phonics instruction produced a moderate effect size (d = .44) in helping children become good readers. Phonics instruction during the younger grades was most effective with a mean effect size for kindergarten (d = 0.56), first grade (d = 0.54), and second through sixth grade (d = .027). Measures of reading comprehension as a result of systematic phonics instruction were also noted with a significant effect size (d = 0.51) in young children. According to the NRP (2002) "these findings should dispel any belief that teaching phonics systematically to young children interferes with their ability to read and comprehend" (p. 94). The National Dissemination Center for Children with Disabilities (NICHCY, 2000) also states that systematic phonics instruction helped children learn to read better than all forms of control group instruction, including whole language. In sum, systematic phonics instruction proved effective and should be implemented as part of literacy programs to teach beginning reading as well as to prevent and remediate reading difficulties. (p. 1)

Vocabulary

Vocabulary words are words that must be comprehended in order for productive communication to take place (National Institute for Literacy [NIL], 2002). A person with a good vocabulary understands specific words and their correct meanings within context. There are two types of vocabulary words: oral and print (Marullis & Neuman, 2010). Oral vocabulary words are the words that are heard and spoken in verbal communication. Print vocabulary words are those read and written in print communication. There are also two forms of word knowledge: receptive and productive. Receptive knowledge is when word meanings are understood as they are heard and read (Lehr, F., Osborn, Jean, Hiebert, & Elfrieda, 2004). Productive word knowledge is a deeper understanding of words in that it is words used in speaking or writing. Most people have a larger receptive vocabulary than productive vocabulary, yet it is the productive vocabulary that demonstrates a deeper understanding of word meaning because it requires this knowledge to be applied in an appropriate manner (Hiebert & Kamil, 2005).

An understanding of vocabulary words is critical to reading acquisition because it helps students make sense of what they read (NRP, 2000). Evidence indicates a correlation between word knowledge and phonological awareness. If a printed word is already in their productive vocabulary, children have an easier time decoding the word and comprehending its meaning. This knowledge helps children map spoken sounds to words in print. (NRP, 2000; Goswami, 2001). Conversely, children who do not have sufficient word knowledge struggle to comprehend the text and often get frustrated. This in turn causes them to read less which provides less exposure to a variety of words, and ultimately results in lower reading comprehension (Stanovich, 1986).

The National Reading Panel reviewed fifty studies conducted between 1979 and 1999 to determine the best instructional methods for teaching vocabulary as well as how it relates to reading comprehension. Although there were no statistics listed for their overall effectiveness, the report does provide a breakdown of the individual studies involved in the meta-analysis with a brief explanation of the type of vocabulary instruction that was used and the general results of their effectiveness. Most of these studies were conducted between grades three and eight. There was relatively little research available on the value of vocabulary instruction for the younger grades (NRP, 2000). The NRP meta-analysis reported two effective methods for vocabulary instruction that positively contribute to reading comprehension: direct and indirect. Direct instruction involves introducing new vocabulary words before reading the text, working with these words in different contexts over an extended period of time (White, Graves, & Slater, 1990), and teaching word-learning strategies (Lehr & Osborn, 2005). Indirect instruction does not involve a formal introduction to previously-unknown words. Rather, children learn vocabulary through conversations with adults, being read to (Dickinson & Smith, 1994), and reading on their own (Herman, Anderson, Pearson, & Nagy, 1987). As previously mentioned, if the word in print is in the reader's oral (productive) vocabulary, there is a higher likelihood that the reader will be able to sound it out. Therefore, larger vocabulary knowledge equates with increased text comprehension (NRP, 2000).

Fluency

Fluency is defined as the ability to read texts quickly and accurately (NIL, 2002). A fluent reader is able to group words together and gain meaning from what is read by reading phrase by phrase rather than word by word (Hooks & Jones, 2002). Readers that become fluent will be proficient in three primary areas: their reading rate, reading accuracy, and reading expression (NRP, 2000; Kuhn & Stahl, 2004). Reading rate can be defined as the pace at which a person is able to orally and/or silently read the text. Reading accuracy refers to the ability to correctly pronounce each word and pause appropriately. Reading expression is the voice inflection that correctly communicates the meaning of what is written. By second or third grade, children are expected to read fluently (quickly, accurately, and with expression). By fourth grade, children are expected to transition from "learning to read to reading to learn" (Chall, 1996).

Studies have shown that oral reading fluency affects comprehension (Nation & Snowling, 1997; Wise et al, 2010) and is thus a critical component of reading acquisition because it bridges the gap between word recognition and comprehension (NIL, 2002). Evidence suggests that fluent reading can be improved through guided reading and repeated reading (NRP, 2000). As the reader is exposed to the words in the text selection multiple times, they become familiar. The working memory, which was previously devoted to decoding, can now focus on comprehension (LPA, 2004).

Because reading fluency is so critical to comprehension, many studies focus on improving this skill. As previously mentioned, guided oral reading and repeated readings are considered the best methods for enhancing reading proficiency. The NRP conducted a meta-analysis of 16 studies to determine the effects of guided oral reading practices. These studies included a variety of learners in a range of classroom settings. Students who were part of guided repeated oral reading groups statistically outperformed students in control groups in all but two studies. The overall average effect size was moderate ($d = 0.48$), although the variance between studies was quite large, ranging from 0.05

to 1.48. Students in these studies ranged from second grade to ninth grade. The results of instruction in guided oral reading weighted a moderate effect size (d = 0.41) on reading achievement. The NRP concluded that guided oral reading practices that include feedback, such as teacher/parent modeling, direct instruction, and positive suggestions about rate expression and accuracy (Conderman & Strobel, 2006) from different people, including teachers, parents, and peers, had a “significant, positive impact on word recognition, fluency, and comprehension across a range of grade levels.” (NRP, 2000, p. 1). The NRP (2002) report further reiterated that “word recognition accuracy is not the end point of reading instruction. Fluency represents a level of expertise beyond word recognition accuracy, and reading comprehension may be aided by fluency” (p. 3-3).

A mixed method dissertation study by Underwood (2010) purposed to determine whether guided oral reading would result in significant improvement in reading achievement as measured by the Illinois Standards Achievement Test (ISAT) on student scores that were tracked through fourth and fifth grade. Fourth and fifth grade students received a 25-minute daily block of guided reading instruction in addition to the 45-minute block of whole-group reading instruction already being delivered. Quantitative results, using a paired-samples t-test, from this study showed a significant correlation between guided oral reading practices and improved student results on the ISAT. The mean score at the end of third grade was 162.79 while the mean in fourth grade was 216.61 with a significant improvement ($p < .001$). The results from fourth to fifth grade were also statistically significant. The mean score at the end of fifth grade was 225.18 revealing a significance of $p < .001$ in reading improvement between grade levels.

Qualitative results also revealed that the teachers believed that this instructional strategy had a positive impact on student reading ability.

Comprehension

The final critical component, and the ultimate goal of reading, is comprehension (NRP, 2000). The importance of comprehension not only for learning in all academic subjects, but also for learning throughout one's entire lifetime (NRP, 2000, LPA, 2004) cannot be overstated. Reading comprehension can be defined as the connection between a reader's own background knowledge (or schema) to what is being read (LPA, 2004). This occurs as the reader uses a variety of comprehension strategies, such as identifying the purpose of reading, asking questions about the text, connecting text to prior knowledge, and summarizing sections of text and then fusing them together to form an overall analysis (Janzen & Stoller, 1998). The use of these comprehension strategies bridges the gap between insufficient language knowledge and literal meaning within the text (Yang, 2006). In order to understand the meaning within the text, the reader must be aware of the thought processes (referred to as *metacognition*) that are occurring during actual reading (NIL, 2002, Yang, 2006). This awareness gives the reader control over the reading process through an active monitoring of thinking strategies in order to determine what is working and what is not.

Comprehension is a critical component of reading acquisition because it enables the reader to gather and understand information from the text. Without comprehension there is no meaning, but rather just senseless symbols on a page (Brummit-Yale, 2012). This reading skill extends its impact into both the academic arena and in life outside of school. It impacts a student's ability to be successful in school because it is reliant on "understanding, analyzing and applying" the information that is gained through reading (Basabara, Yovanoff, Alonzo, Tindal, 2012).

The National Reading Panel conducted a meta-analysis of 204 studies and ascertained that there are seven methods of reading comprehension instruction with solid scientific evidence of their positive effects on student reading abilities. These methods include: comprehension monitoring (teaching readers to monitor their own understanding of the text), cooperative learning (using different reading strategies together as a group), graphic and semantic organizers (diagram or other pictorial format illustrating text interrelationships), question and answers (students answer questions that are given by the teacher and are given feedback on those answers), question generation (students ask themselves questions about what was read), story structure (ability to recall the organization of the story to answer questions about what they read), and summarization (generalizations from the text selection) (NRP, 2000). According to the NRP (2002), of all these strategies, the question generation strategy produced the strongest scientific evidence of effectiveness, although teaching a combination of these reading comprehension strategies is considered the most effective.

Reading acquisition enables the individual to acquire meaning from print. It is a combination of word recognition and literacy comprehension (Gough & Tunmer, 1986). Phonemic awareness and phonics instruction help the reader to decode the symbols on the page. Vocabulary knowledge attaches meaning to specific words in the text. Fluency involves the ability to connect the text together at an appropriate rate, with accuracy and good expression in order to gain an overall view of the message being portrayed. Comprehension is the ultimate goal of reading and enables the reader to understand the message as connections are made from background knowledge to the text. All of these skills combine together to create the reading experience and are the essential components of skilled reading.

Factors Contributing to Children's Reading Difficulties

Studies show that a deficit in phonological awareness, which is an understanding of the sound structure within words, is the primary underlying reason for poor written and oral language comprehension (Vellutino, Fletcher, Snowling, & Scanlon, 2004; Scarborough, 1998; Badian, 1998). Poor phonological awareness in young children is evidenced by slow oral and silent reading rates and impaired spelling abilities (Fuchs et al., 2012; Manganaro, 2011). Since these children have not mastered the basic sounds and are thus unable to easily identify the name and/or sound of the letter, this leads to difficulties with word identification (Wiig & Menyuk, 2004). Pseudowords (or nonsense words) are commonly used to identify deficits in this sound-symbol correspondence in young readers because such words do not allow the children to rely on memory, visual clues, or context clues when decoding. (Miller-Shaul, 2005).

Biological Factors

When considering the factors that contribute to reading deficits perhaps the most commonly recognized and scientifically studied are biological in nature. Interestingly, 50-60% of reading disabilities have some type of genetic linkage (Vellutino, Fletcher, Snowling, & Scanlon, 2004). Family segregation studies report that, on average, a child is eight times more likely to be diagnosed with a reading disability if either parent has the disability. Furthermore, if the child suffers from a reading disability, there is a 25%-60% likelihood that one parent has also been diagnosed (Grigorenko, 2001, Fisher & DeGries, 2002). Five different laboratories have also identified a gene on chromosome 6 that has been linked to people with reading disabilities (Grigorenko, 2001; Paracchini, Scerri, & Monaco, 2007). This provides further evidence of the strong genetic influence on reading disabilities.

Brain imaging studies have indicated that certain people who experience one of the most prevalent reading disabilities diagnosed among school-aged children, dyslexia, (Shaywitz & Shaywitz, 2005), have a difference in brain *function* and *composition* when compared with the brain of non-dyslexic persons. Although the sample population of the current dissertation study does not involve a large number of diagnosed dyslexic students, difficulties that struggling first grade readers have oftentimes mirror those of dyslexics, and students with pervasive issues may eventually receive that diagnosis. The International Dyslexia Association (2007) lists several common potential symptoms of dyslexia in young children. These symptoms include:

1. Difficulty reading single words, such as a word on a flashcard
2. Difficulty learning the connection between letters and sounds
3. Confusing small words, such as *at* and *to*
4. Letter reversals, such as *d* for *b*
5. Word reversals, such as *tip* for *pit.* (p. 1)

While these studies give a greater understanding of the biological make-up of those who struggle with this specific learning disability, similarities between the difficulties encountered by early struggling readers and older dyslexic students and adults give rise to the need for a discussion as to the potential biological factors that contribute to these difficulties.

Studies comparing brain *function* focus on the location and amount of brain activity during cognitive reading tasks (Shaywitz et al., 2002; Stoodley & Stein, 2013), while studies comparing brain *composition* focus on the volume of gray and white matter within specific regions (Booth & Burman, 2001; Klingberg, Hedehus, Temple, Salz, & Gabrieli 2000; Deutsch et al., 2005), and the symmetry of the left and right hemispheres (Heim & Keil, 2004). A major focus for both brain composition and brain function studies is on the ability to map sounds to print (i.e., associate sounds with their connected letters) (Stoodley & Stein, 2013; Booth & Burman, 2001; Klingberg, et al., 2000; Brunswick, McCrory, Price, Frith & Frith, 1999; Shaywitz et al. 2002). According to Frey and Fisher (2010),

> letter and sound recognition must be . . . coordinated with the auditory areas of the brain that process the sounds of language and assemble them into meaningful strings. This loop between the occipital lobe, Broca's area in the [left] frontal lobe [associated with the production of language] and Wernicke's area in the left temporal lobe [associated with the processing of spoken words] must be trained to coordinate efficiently. Any disruption in this pathway can potentially interfere with reading comprehension. (p. 104)

Evidence of differences in brain function has been gathered from studies conducted on dyslexic and non-dyslexic children while they were performing reading-related tasks. In one of the largest studies conducted on this subject, Shaywitz et al. (2002) examined 144 children, 70 dyslexic readers and 74 non-impaired readers between the ages of 7 and18 years with a mean age of 13.3 years. These children were required to do the following cognitive processes: identify the names or sounds of letters, sound out nonsense words, and sound out and compare the meanings of real words. Brain images were taken of the children as they were performing these skills. The results of the study showed that children who were fluent readers had a higher amount of activity in the left, as opposed to the right, hemisphere of the brain ($p < .001$). Shaywitz et al. (2002) noted a positive correlation between reading skill and activation in the left occipital-temporal region of the brain, the area involved in critical reading skills, and a negative correlation between reading skill and activation in the right occipital-temporal region. In other words, there was an underactivation in the area involved in critical reading skills and an overactivation in the areas of the brain where compensating strategies were potentially being used in order to accomplish the reading tasks.

A study by Brunswick, et al., (1999) focused on the Wernicke and Broca areas of the brain by examining brain activation patterns in six dyslexic males and compared them with six non-dyslexic males during reading-related tasks involving reading aloud simple words and pseudo (nonsense) words. The dyslexic readers showed less activation in the left posterior inferior temporal cortex (part of Wernicke's area) during these literacy tasks. They also noted that the dyslexic males had greater activation in the Broca areas (*p*=.001) during the read aloud experiment. The researchers suggested this was due to compensatory strategies being used because the two areas were not working together with the same intensity. These studies by Shaywitz, et al., and Brunswick, et al., provide convincing evidence that the brains of dyslexic individuals function quite differently, particularly with regard to the location and amount of brain activity used during the reading process, compared with those who do not struggle with this reading deficiency.

Not only does the brain *function* differ between those with and without dyslexia, but multiple brain imaging studies also provide evidence that the brain *composition* in these two groups also differs from one another. One study on brain composition by Booth and Burman (2001) shows that persons with dyslexia have less gray matter in the left parietotemporal area, which is the area that appears to be involved in word identification (i.e., decoding skills used in alphabetic mapping). Gray matter consists of nerve cells and is used for processing information. Thus, less gray matter would indicate a decreased ability to process language appropriately (i.e., phonological awareness). The researchers also found that those with dyslexia had less white matter in the left parietotemporal region of the brain, which is the area that aids in correlating written words to spoken words. White matter within the language areas of the brain coincide with reading abilities (Klingberg, et al., 2000), and are responsible for helping different areas of the brain to communicate with each other. A reduction in white matter within these language areas therefore is thus thought to be responsible for slowing a reader's processing speed (Booth and Burman, 2001).

The brain is composed of both a left and a right hemisphere, each of which is responsible for performing certain functions. The left hemisphere contains the primary components used during the reading process, (Hudson, High, & Al Otaiba, 2007; Leonard et al., 2001; Stoodley & Stein, 2013; Shaywitz & Shaywitz, 2007), and is, in cases of strong readers, often observed to be slightly larger than the right hemisphere (Leisman, et al, 2010). Galaburda, Rosen, and Sherman, (1990) performed a comprehensive post-mortem study on five diagnosed cases of developmental dyslexia. Autopsy results showed that all five of the deceaseds' brains exhibited an enlarged right-hemisphere indicating the possibility that this side of the brain was used more during the reading process than the left hemisphere. Leonard et al. (2001) conducted MRI scans on 15 college students who had been diagnosed with a reading disability. These scans were compared with 15 controls who were matched "on the fluid reasoning cluster of the Woodcock Johnson test of Cognitive Abilities-Revised (WJ-Cog), sex, and a quantitative measure of handedness" (p. 149). Cerebral size was measured by "dividing the left and right differences by the average volume of the two hemispheres" (p. 150). Reliability for these measurements was 0.87. These measurements showed a significant rightward asymmetry in the cerebral hemisphere of those students that were diagnosed with a reading disability. Both of these studies suggest that among those who struggle to read, right hemisphere of the brain tends to be larger than the left.

The question has been raised by researchers as to whether these structural brain differences are the *cause* of reading difficulties or rather the *result* of reading difficulties. The best way to answer this question would be to analyze the brain composition of pre-reading children at-risk for dyslexia with children who are not at-risk. Raschle (2011) recently conducted such a study comparing the brain structure of pre-reading children with a family history of dyslexia with the brain structures of pre-reading children who have no such history. The results showed that the gray matter volume in the at-risk children was much smaller in several areas of the brain that impact reading ability: the left occipitotemporal, bilateral parietotemporal, left fusiform gyrus, and right lingual gyrus. Because the gray matter in the brain aids in processing information, a lesser volume of these nerve cells in at-risk children would indicate that these brain structures are in place prior to reading acquisition. In other words, the evidence from this study suggests that structural brain differences are indeed the cause, rather than the result, of reading deficiencies.

Environmental Factors

A child's environment, which consists primarily of his home and school life, contributes greatly to his reading abilities and disabilities (Israel, Beaulieu, & Hartless, 2001; Hazelrigg, 2008; Downey, 2001). In a child's home, the extent to which the English language is spoken and written (NCES, 2011; Hazelrigg, 2008) as well as his socioeconomic status (SES) (Israel,et al., 2001; Baker, 2010) play critical roles influencing his ability to read. At school, factors include teacher expectations for student achievement (Muller, Katz, & Dance, 1999) and other characteristics specific to the school, including the school's commitment to high academic achievement, the overall school climate as it relates to safety and orderliness, the frequency of student progress evaluations, and the school's leadership.

The number of children in the United States who speak a primary language at home other than English rose from 10% in 1980 to 21% in 2009 (National Center for Educational Statistics [NCES], 2011). These students are often referred to as English Language Learners (ELL). On the 2013 national reading assessment, 69% of ELLs performed below *Basic,* 31% performed at or above *Basic*, 7% at or above *Proficient*, and 1% performed at the *Advanced* level (NCES, 2013). These results are likely due to the fact that ELL students, as compared to their English-speaking counterparts, have less background knowledge of English vocabulary and culture and they enter school at a disadvantage due to their limited exposure to and practice of the English language in the home (Hazelrigg, 2008).

Many research studies have shown a correlation between children's SES and its effect on their educational abilities. (White, 1982; Coleman, 1988; Israel, et al., 2001). A study by Baker (2010) examined 14,049 eighth grade students from 51 middle schools to determine the extent that SES has on academic achievement as measured by the Florida Comprehensive Achievement Test (FCAT). Of the 51 schools assessed, 31 schools (9, 321 students) received Title 1 funds, which are federal grants providing financial assistance to schools with high percentages of children from low-income families, while 17 schools (4,728 students) did not receive these funds. Thirty-nine percent of the group receiving Title 1 funds passed the FCAT whereas 65% of those passed that did not receive Title 1 funds. These results clearly suggest that SES correlates with student achievement. The question of what creates this correlation, however, is a complicated one filled with moral, social and public policy issues that stretch well beyond the scope of this study. A review of the academic literature on the subject, however, suggests a strong factor influencing this correlation is the poor home literacy environment found in many low SES families (Share, Jorm, Maclean, Matthews, Waterman, 1983; Molfese, DiLalla, and Brunce, 1997). One or more of the following variables, any one of which can contribute to a poor literacy environment, will usually be present in a low SES family: a single parent household (Entwisle & Alexander, 1996); an increased number of siblings (a large family size) (Blake, 1989); and no college or advanced degree on the part of the mother (Moore & Schmidt, 2004). Each one of these variables, when present, has the potential to negatively influence a child's reading ability. When multiple variables exist within the same low SES home, the potential for reading disabilities increases dramatically. (Noble, Farah, & McCandliss, 2006).

A child's school environment also plays a pivotal role in contributing to the success or struggle a child will have in reading. Student perceptions of their teachers' expectations can directly influence student attitudes and motivation in school, both of which relate directly to achievement (Muller, Katz, & Dance, 1999). This perception becomes a self-fulfilling prophecy such that children will often achieve whatever expectations are set upon them (Brattesam, Weinstein, & Marshall, 1984). Furthermore, schools that are well organized with clear and fair expectations set upon the students are linked with higher academic achievement (Lee & Bryk, 1989). Educational leadership in particular, influences school-wide student achievement. (Wilson, 2011). According to Leithwood, Louis, Anderson, and Wahlstrom (2004) a school's ability to convert from a low performing to high performing school rarely occurs without a strong and capable principal. The frequency of student progress assessments is yet another school characteristic that influences reading achievement. As schools, and specifically teachers, evaluate their students' achievement, curriculum decisions and individual classroom teaching-style decisions can be made to best suit learners (Wilson, 2011). The more often evaluations take place, the higher the probability that instruction can be individualized, thereby positively affecting student reading outcome.

Many researchers have noted what is called the *Matthew Effect* with respect to children's reading achievement. This term comes from a passage in the Bible book of Matthew that refers to the rich getting richer and the poor getting poorer (Stanovich, 1986). Students who enter school rich in home-based literacy activities, parental support, and higher SES tend to move faster through the beginning skills of alphabetic and phonemic awareness and become better readers at an earlier age. Conversely, students who do not have these similar backgrounds will often struggle at the onset of school. As the negative factors of low SES, lack of home literacy support, etc., stay consistent, the poor just get poorer. This gives cause to evaluate our current approach to the identification and remediation of young children struggling to read in order to determine best practices and identify any gaps in the process.

Clearly, reading difficulties can have both biological and environmental causes, although environmental influences have the potential to change biological attributes. As Frey and Fisher (2010) describe, "experience changes neural connections. When we experience something, neurons fire. Repeated firings lead to physical changes that, over time and with repetition, become more permanent" (p. 105). In light of this strong environment-biological connection, there is a great need to create a literacy-rich environment for young readers in order to provide them opportunities to establish and solidify pathways to the brain that will enhance their reading abilities.

Explanation of Multisensory Language Instruction

Definition and Description of Multisensory Language Instruction

The term *multisensory structured language education* originated with the International Dyslexia Association (IDA) as a general description of the specific characteristics of the Orton-Gillingham approach to teaching reading and language (International Multisensory Structured Language Education Council [IMSLEC], 2013). IDA (2009) describes the multisensory method as one that:

> involves the use of visual, auditory, and kinesthetic-tactile pathways simultaneously to enhance memory and learning of written language. Links are consistently made between the visual (language we see), auditory (language we hear), and kinesthetic-tactile (language symbols we feel) pathways in learning to read and spell. (p. 1)

The acronym VAKT (visual, auditory, kinesthetic-tactile) (IDA), or the Language Triangle (Ritchey & Goeke, 2006), are terms often used to refer to these different physiological senses involved in multisensory instruction. Although multisensory instruction is generally understood to include an emphasis on kinesthetic-tactile learning, it is much broader than that. It is an approach to learning that uses methods of instruction designed to reinforce brain pathways in both the gathering of information (input) and the communicating of that information (output).

The International Multisensory Structured Language Education Council (IMSLEC) explains that a multisensory approach to language instruction generally features certain content (*what* is taught) and principles (*how* that content is taught) (IMSLEC, 2013). The content consists of phonology, sound-symbol association, syllable instruction, morphology, syntax, and semantics. The principles consist of the simultaneous use of multiple senses (VAKT) that are taught systematically and cumulatively, direct instruction that is taught diagnostically, and synthetic and analytic instruction. The IMSLEC summarizes the features of multisensory instruction as the following:

<u>Content of Multisensory Instruction</u>

- *Phonology:* This is the study of sounds as they relate to our language. Phonology includes the skill of phonological awareness (the ability to recognize words as comprised of individual sound units) and its subskill, phonemic awareness (the ability to distinguish and manipulate individual sounds, referred to as phonemes).
- *Sound-Symbol Association:* This can also be termed phoneme (sound)-to-grapheme (letter) correspondence. It is the ability to recognize individual letters or letter clusters and give the correct sounds for them. Sound-symbol associations are taught bi-directionally using the visual and auditory, and kinesthetic-tactile senses. This means that as the letter is displayed (visual), the student must produce the corresponding letter (kinesthetic-tactile), and as the letter sound is given (auditory), the student must write, or point to, the appropriate letter (kinesthetic-tactile).

- *Syllable Instruction:* A syllable is the individual unit of language consisting of a single uninterrupted sound, containing at least one vowel sound. There are six syllable types commonly taught: closed, vowel-consonant-e, open, consonant-le, r-controlled, and vowel teams. Syllable instruction should directly relate to word configuration.
- *Morphology:* This is the study of the smallest units of meaning within language. Morphemes consist of base words, suffixes, prefixes, plurals, and past/present/future tenses. An understanding of morphology is important for vocabulary development.
- *Syntax:* This is the study of how individual words are grouped together to form meaningful sentences. Grammar, sentence variation, and mechanics of language are all components of syntax instruction.
- *Semantics*: This is the figurative meaning behind language. It moves beyond the literal meaning of a word and is dependent on a cultural understanding of the language being communicated.

Principles of Multisensory Instruction

- *Simultaneous, Multisensory (VAKT):* Instruction that uses the different learning modalities (visual, auditory, kinesthetic-tactile) concurrently in order to help reinforce the brain pathways necessary for making the connection between sounds and letters.
- *Systematic and Cumulative*: The organization of language skills is taught in a specific order from simple to complex. Each new skill builds upon what has

already been learned. All skills are consistently reviewed and reinforced in a variety of contexts in order to achieve automaticity.

- *Direct Instruction:* Instruction is directed from the teacher to the student. The learning outcomes are explicitly defined, taught, and assessed.
- *Diagnostic Teaching*: Instruction is individualized through continuous assessment. Mastery of each skill is a prerequisite for the introduction of new skills.
- *Synthetic and Analytic Instruction*: Synthetic is a part-to-whole form of instruction. Teaching begins with individual letters sound and letter blends and progresses to words and sentences. Analytic is a whole-to-part form of instruction. Teaching begins with sentence structure and progresses downward to words and letters.

The Goal of Multisensory Language Instruction

Students with reading disabilities often exhibit a breakdown in the neurological pathways between the connections of sound (phonological) and print (orthographic) in language. The goal of multisensory instruction is to bridge the gap in these neurological pathways by making sound-symbol correspondences “click” for children and adults who may otherwise have difficulty making the connection. It does so by utilizing the multiple senses to make that initial connection and then by continuing to reinforce it, which serves to then strengthen and eventually solidify understanding (IDA, 2009).

The Wilson Reading System Approach

A number of commercial multisensory reading programs are available on the market today, many of which base their instruction on the Orton-Gillingham approach. One of the most notable of these programs is the Wilson Reading System (WRS), and much of the current dissertation study uses methods drawn from the WRS. The Wilson program was developed by Barbara Wilson while she was working in the Massachusetts General Hospital's Language Disorders Unit as well as in her private tutoring business. She saw that there were very intelligent people who had great difficulty learning to read because they could not understand the structure of the English language. She had received training in the Orton-Gillingham (OG) multisensory approach, which, combined with her work experience, led her to develop the WRS. This system seeks to break down the structure of the English language into its individual components using the phonics approach but adds in methods for reinforcing letter-sound correspondence through the use of the different physical senses (Wilson Language Series [WLS], 2010).

The International Dyslexia Association (IDA) has listed 5 components of the English language: "(a) phonology, (b) phonics and word study, (c) fluent, automatic reading of text, (d) vocabulary, (e) handwriting, spelling, written expression" (p. 1). The WRS multisensory approach takes these components and systematically teaches each one to the point of mastery by involving the different senses. They are taught bi-directionally with a focus on encoding (sound-to-letter correspondence) and decoding (letter-to-sound correspondence) relationships in order to establish a better connection between sound and print. It also integrates fluency and reading comprehension with controlled texts (Wilson, 1989).

The decoding section of a WRS lesson consists of five elements:

1. *Quick drill*- students give the name/keyword/sound for each color-coded sound card that is shown
2. *Teaching and reviewing reading concepts*- in initial lessons, students segment sounds within a word using a kinesthetic-tactile finger tapping procedure; in later lessons, total word structure analysis is taught using syllable and suffix cards
3. *Word cards*- students read words, in flashcard style, containing word structure elements from previous and current lessons
4. *Wordlist reading*- students read controlled wordlists and are charted daily for independent success
5. *Sentence reading*- word attack skills are applied to sentence reading; words in the sentences only contain skills that have been explicitly taught

The encoding section of the lesson consists of three elements:

1. *Quick drill (in reverse)*- teacher gives the sound and student identifies corresponding letter(s) using color-coded cards or tiles
2. *Teach and review concepts for spelling*- student applies tapping procedure to spelling of words and visually represents words using sound cards

3. *Written work*- sounds, single words, and sentence dictation by teacher. Word structure is reinforced through written spelling of words by students

The last two parts of the lesson make up the fluency and reading comprehension section of the lesson:

1. *Passage reading*- students silently read texts with controlled vocabulary. Students retell passage and use visualization strategies to aid comprehension of story elements.
2. *Listening comprehension activities*- teacher reads non-controlled texts to students. Students use visualization strategies to retell story

The Impact of Multisensory Language Instruction on Struggling and At-Risk Readers

Studies have shown that when a multisensory approach to teaching phonics is introduced to children who struggle to read, in most cases their reading and overall achievement scores improve. A dissertation study by Stewart (2011) tested the Orton-Gillingham method of phonics instruction (multisensory, explicit, and systematic) versus an embedded phonics instructional approach with no multisensory component (teaching phonics skills as they arise in connected text) on first grade reading achievement. The participants in this study had previously scored at or below the 30th percentile on the district's First Grade Inventory. The independent variable was the multisensory phonics instruction. The treatment group consisted of twenty-five students and the control group consisted of twenty-six students. The treatment group received 45 minutes of daily instruction for twelve weeks in systematic, synthetic (part-to-whole) multisensory phonics instruction. Lessons were highly-structured and involved all VAKT senses. The control group also received 45 minutes of daily small group instruction for twelve weeks that focused on the phonics skills that were specified in the district's basal reading program. The phonics program for the control group had a whole-to-part emphasis where special sounds were identified within whole words. Lessons in the control group were not scripted and instruction was only visual and auditory. The dependent variables were two Woodcock Reading Mastery subtests: word attack and word identification. The word attack subtest measured students' abilities to apply knowledge of phonics rules to pseudo (nonsense) word decoding. The word identification subtest measured students' abilities to decode real words. Using a repeated measures t-test to measure intervention effectiveness, the results showed that the treatment group improved significantly (M = 10.04; SD = 6.03) over the control group (M = 6.03; SD = 2.10) on the decoding word attack (nonsense word) subtest. The difference between the groups was significant and the effect size was large (p= .000; t (49) = 6.25). On the decoding word identification (real word) subtest, both experimental and control groups made significant gains on the posttest compared to the pretest, although the gain score mean was greater for the treatment group (9.04 pts.) than the control group (2.56 pts.). This study suggests a strong correlation between an improvement in decoding abilities and the use of multisensory techniques used in conjunction with a systematic phonics instructional approach.

Wilson and O'Connor (1995) conducted a study to determine whether a special education pull-out program with a teacher trained in multisensory methods (from the

Wilson Reading System) that focused on encoding and decoding instruction would result in student progress in reading and spelling skills. The participants included 220 students ranging from grades 3-12. Just under half (92) of these students were in the third and fourth grade and the rest of the students (128) were in grades 5-12. Thirty-five percent of these students had been retained at least one grade and most of them received special education services in the form of pull-out instruction. Progress was measured in word attack (nonsense words), passage comprehension, and total reading using the Woodcock Reading Master Test-Revised (WRMT-R, Forms G and H) or the Woodcock Reading Mastery Test (WRMT, Forms A and B). Students were also tested on their spelling achievement using the Wilson Reading System Test. The teachers participated in a two day workshop where they were taught Wilson-based multisensory instructional methods. They were taught how to follow the Wilson lesson plans and were periodically supervised in their implementation of this program by a Wilson Language Trainer during the study. Teachers also attended monthly seminars throughout the school year. Students received two to three individual tutoring lessons per week throughout the school year.

Paired t-test results revealed significant gains in word attack and passage comprehension on the Woodcock Reading Mastery Tests and gains in spelling achievement on the Wilson Reading System Test. Results were reported by grade-level gains. Students averaged a 4.6 grade level gain in word attack, a 1.6 grade level gain in passage comprehension, and a 1.9 grade-level gain in total reading. The spelling results averaged a raw score gain of 10. All results, including word attack, passage comprehension, total reading, and spelling were statistically significant ($p < .001$). According to the researchers, these findings revealed a positive correlation between multisensory instruction from trained teachers and improvement in student reading and spelling abilities. The teachers also noted a gain in student confidence as reading abilities increased throughout the school year. The researchers discussed the need for more intensive, structured, and explicit reading and spelling instruction, especially due to the trend for inclusion of special education students within the regular classroom.

Research on the use of encoding and decoding instruction (major components of multisensory language instruction) has provided empirical evidence of its positive effects on the performance of students who struggle with reading and spelling. According to Popp (2004) “practice in writing letters to represent words, a common way to practice phonics skills, allows children to recognize that their spoken words can be separated into smaller units of sounds and a visual representation can be assigned” (p. 51). In a recent study, Weiser (2010) sought to determine whether integrating encoding (spelling) instruction within a reading curriculum provided stronger gains for first grade students struggling with reading than programs that included little or no encoding instruction. A total of 175 first grade students participated in this study. Students were identified by their classroom teacher as showing some risk for reading difficulties. The researcher (along with five research assistants) screened all recommended students to identify those performing below the 20^{th} percentile. In order to eliminate any “compensatory rivalry” (p. 99) between students or their teachers, there was no control group used in this study. All 175 students received their regular 90 minutes of daily language arts instruction.

During the study, they received an additional 30 minutes of daily small group encoding instruction in encoding activities. Each participating school's reading specialist received four 6-hour training sessions to learn how to teach the encoding instruction to the treatment group. Growth was measured in phonemic awareness, decoding real and nonsense words, encoding dictated words, comprehension, and fluency. The research used a cross-classified instructional model to measure growth at the student level by incorporating variables from the classroom teachers and the intervention teachers. The small group supplemental instruction by the reading specialist was observed periodically throughout the school year by the research team using a rating scale to evaluate implementation reliability. Classroom teachers were also observed during the 90-minute language block sessions to determine to what extent decoding and encoding instruction was provided as well as the amount of time spent on this instruction. This enabled the research team to take into account influences from both elements and evaluate their impact both separately and collectively on students' reading and spelling performance. Effect sizes of the treatment group gains were statistically significant ranging from 0.80 to 3.43 collectively on the post-test results. The results also confirmed a reciprocal relationship between decoding ability and encoding performance in all areas of reading and spelling.

Blachman et al. (2004) also conducted a study examining the interaction between encoding and decoding activities in helping struggling students connect letters to sounds. The treatment group included 126 second and third graders in the bottom 25th percentile of word identification skills. Over a period of eight months, these students received one-on-one daily instruction which included teaching letter/sound correspondences, segmenting and blending of phonemes within words using manipulatives, reading words on flashcards and in connected texts, and phoneme/grapheme associations to form words through written work. The control group received either the school's prescribed core classroom reading instruction or other related reading resource instruction. Posttest assessments evaluated real and nonsense word reading, reading rate, passage reading, and spelling. These assessments revealed significant improvement of the treatment group in decoding, word reading efficiency, phonological awareness, rapid naming of letters, and spellings. Effect sizes ranged from 0.21 to 0.78, revealing a moderate to strong correlation between the intervention and improved students decoding and encoding skills.

A collective reading of the previous studies suggests that systematic and explicit multisensory phonics instruction makes large inroads into improving student reading achievement among struggling readers. The results are less clear, however, when the subjects being studied are considered "treatment resisters." Campbell (2004) conducted a dissertation study to examine the effects of adding in a multisensory component of instruction for those children who had not previously responded to an explicit and systematic phonics approach to the teaching of reading. According to Torgesen (2000), approximately 2% to 6% of children fall into this category. The participants for this study were six second grade students who were all identified as "treatment resisters." These students, who had previous reading instruction in *Open Court*, an evidenced-based reading program with a focus on explicit and systematic phonics instruction, had failed to reach grade level benchmarks on the nonsense word fluency and oral reading fluency subtests of the Dynamic Indicators of Basic Early Literacy Skills (DIBELS) assessment. The researcher provided these students with an additional 20 lessons using *Practice Court (PC)*, an explicit and systematic phonics-based reading program in addition to the *Open Court* school reading program, and conducted a pre and post evaluation to confirm them as "treatment resisters." Once these students were confirmed as "treatment resisters," the researcher introduced the additional multisensory intervention, which consisted of 12 weeks of daily 10 minute one-on-one lessons following the PC instruction with the added component of multisensory instruction. The multisensory instruction included decoding and encoding activities. The students used a finger-tapping procedure for sounding out words and manipulated letter tiles to form words on a baking sheet. Phonemic awareness was demonstrated as the student made appropriate changes to the letter tiles that corresponded with the changes in the dictated words. For example if the word was changed from "dog" to "hog," the student would switch out the letter "d" for the letter "h". As the words were read, the student would touch each letter tile and produce the corresponding sound. Although no statistically significant results were discussed in the study results, all six students improved in their ability to decode nonsense words. However, none of the students achieved the maintenance goal on the DIBELS benchmark of 25 correct nonsense words per minute. Campbell hypothesized that due to the fact that these students already had identified weaknesses in the alphabetic principle and did not respond to previous intervention using systematic and explicit phonics instruction, it could be assumed that they would not be as responsive to this treatment as would be non-treatment resisters who would more likely apply new knowledge of the alphabetic principle at a faster rate. Campbell did state that the "results of this study indicate a functional relationship between the addition of multisensory components to a supplemental reading intervention and fluency of decoding VC [vowel-consonant] and CVC [consonant-vowel-consonant] nonsense words" (p. 89).

The Impact of Multisensory Language Instruction in the Regular Classroom

Because multisensory methods are often used with students that are exhibiting some type of reading difficulty related to phonological awareness, most of the research focuses on this particular group. However, several studies provide evidence that multisensory methods improve overall student scores rather than just the scores of those who are struggling. Scheffel, Shaw, and Shaw (2008) sought to evaluate the effectiveness of Orton-Gillingham multisensory instruction within three different schools. The participants were 702 first grade students. The treatment group consisted of 226 students and the control group included 476 students. Both treatment and control groups within this study contained a mix of *low* and *average* readers. Both groups received 90 minutes daily of traditional reading instruction using the district's approved curriculum. The treatment group received 30 minutes daily of supplemental instruction using the Orton-Gillingham multisensory program. Classroom observations of proper implementation were used to ensure variables were limited to additional use of the supplementary program. The teachers completed satisfaction surveys of program effectiveness and the students were given a fall, winter, and spring assessment using the Dynamic Indicators of Basic Early Literacy Skills (DIBELS) to measure achievement in the areas of phonemic awareness and the alphabetic principle using the phonemic segmentation fluency (PSF) subtest, the nonsense words fluency subtest (NWF), and the oral reading fluency (ORF) to measure achievement in the areas of phonemic awareness and the alphabetic principle.

Those students at greatest risk for reading failure within the treatment group (bottom 25th percentile) measured the greatest improvement in phonemic awareness skills as measured by the PSF subtest. The at-risk students in the treatment group scored above the DIBELS benchmark from winter to spring assessments while the control group scored below the DIBELS benchmark. From the fall to winter assessments, the treatment group transitioned 25% and the control group transitioned 20% of the *some risk* students to the *low risk* category. The author also noted that the progress of phonological awareness skills during the fall and winter assessments for students in both groups within the bottom 5^{th} percentile was very similar, yet the treatment group measured much greater gains in alphabetic principle, measured by the NWF, during the winter and spring assessments. Although the overall impact was greatest on those students that were considered at-risk during the study, the NWF scores for students in the low-risk category in the treatment schools were significantly higher than the low-risk students in the control group schools (p= .001) (Scheffel, Shaw, & Shaw, 2008).

Bitter and White (2011) conducted a large-scale, longitudinal study to determine the effect of multisensory language instruction compared to conventional basal reading instruction. The sample size was over 1,000 students across eleven schools. These students participated in the study from kindergarten through the third grade. The control group students were given 80 minutes of daily instruction using a district-approved basal reading program: Harcourt or Houghton Mifflin. The treatment group students were given 90 minutes of daily instruction using the *Writing Road to Reading*, which was developed by R. B. Spalding and contains components of the Spalding method. This is a multisensory method that explicitly and systematically teaches letter-sound correspondences and integrates the use of spoken language with reading and spelling. It is important to note that the Arizona Department of Education (the state in which the research study took place) concluded that the reading programs used in both treatment and control groups contained instruction in the five critical components of reading as identified by the National Reading Panel. Therefore, these components could be eliminated as variables.

Four subtests of the DIBELS were used for the kindergarten students: Initial Sound Fluency, Letter Naming Fluency, Nonsense Words Fluency, and Word Use Fluency. However, by year four of the study, only data from the Oral Reading Fluency subtest was available on all schools. Results from this study yielded a statistically significant result ($p < .001$) in favor of the treatment group. The treatment group also performed better than the control group on all previously listed subtests from kindergarten through third grade. These results were validated by the state-mandated achievement test, the TerraNova, which was administered during the third year of the study to all second graders. Results confirmed the DIBELS scores and revealed that the treatment group significantly outperformed the control group on the reading portion of TerraNova ($p < .01$).

The Impact of Supplementing a Basal Reading Program with Multisensory Language Instruction

Trepanier (2009) conducted a study similar to the one addressed by this dissertation and sought to evaluate the effectiveness of supplementing a basal reading curriculum with Orton-Gillingham (OG) phonetic instruction within the regular classroom. Approximately 50 students in first and second grade participated over a nine month period. In both grades, there was a control group class and a treatment group class. All of the classes in both grade levels spent 120 minutes a day on reading instruction. As part of this 120 minute block, the treatment group instruction was disseminated using multisensory methods. Assessment of pre and post achievement levels was conducted using the STAR Reading test, which determined the students' reading levels. An analysis of the data revealed that there was no significant difference between the treatment group and control group in either first or second grade. However, despite this fact, the average reading level gains were greater for both treatment groups (1.07333 for first grade and 0.70000 for second grade) than they were for the control groups (0.65000 for first grade, 0.6780 for second grade). This provides some evidence that even students who are not at-risk for reading difficulties can benefit from supplemental, explicit, systematic multisensory instruction of reading.

Negin (2009) also conducted a study evaluating the effectiveness of supplemental multisensory instruction to an established basal reading program. Students in a third grade classroom were divided into two fifteen-subject groups: control and treatment. All of the students were given the reading subtest of the Stanford Achievement Test. This test measured word reading skills and reading comprehension skills. The control group (Group B) spent fifteen minutes a day silently reading trade books of interest to them. The treatment group (Group A) spent fifteen minutes a day listening to audio tapes of the same books as Group B. The students followed along by moving their fingers under the words. One of the major components of multisensory instruction is the usage of the visual, auditory, and kinesthetic-tactile component simultaneously. In Group A (the treatment group), the students looked at the words (visual) listened to them being spoken (auditory), and moved their finger across the word(s) as they were being read aloud (kinesthetic-tactile). The Stanford Achievement Reading subtest was administered a second time as a post test. While both groups improved on their reading scores, Negin found that the treatment group (Group A) showed a greater level of reading achievement, as indicated by an average of a two-month reading gain over the control group (Group B). According to Negin, the "differences between the two groups should be attributable to the multisensory component in the treatment for Group A" (p. 381).

These results are corroborated by a similar study conducted by Malatesha, Dahlgren, and Boulware-Gooden (2002). Control group students were taught using the Houghton-Mifflin basal reading curriculum and treatment group students were taught using the *Language Basic: Elementary* which includes components of *Alphabetic Phonics* a multisensory language program. While both treatment and control groups made statistically significant gains in reading comprehension, the treatment group also made statistically significant gains in phonological awareness and decoding. These results provide evidence that multisensory instruction within the regular classroom improves overall student performance in reading.

Conclusion

The theory and implementation of multisensory language instruction has been discussed for decades. This approach is considered effective because it focuses on the core component of phonological awareness and more specifically phonemic awareness, both of which are implicated in reading disabilities. Its ability to adapt to different learning styles makes it a popular choice for special educators and regular classroom teachers who want to improve their students' reading fluency.

CHAPTER III

METHODS AND PROCEDURES

Introduction

This is an experimental study with the purpose of assessing two different reading method treatments on first grade students and determining the effects of these treatments within and among the two groups. The method of instruction is the independent variable. The dependent variable is the improvement scores of students, as measured by a pretest and posttest, on decoding, as measured by word identification (real word) and word attack (nonsense word) subtests, encoding (spelling ability and phonics points), and oral reading fluency skills. The sample population included four intact classrooms- two that received the intervention teaching methods (the treatment group) and two that did not (the control group). This chapter presents a restatement of the problem studied, along with a restatement of the research questions and null hypotheses. It also includes a description of the research design and the intervention methods, the sample population, test instrument measurements and data treatment from those tests, as well as how the data from those tests was analyzed. The chapter concludes with a summary of the pilot study.

Restatement of the Problem

The purpose of this study was to determine whether and to what extent the decoding, reinforcement, and (2) classroom reading program supplemented with multisensory methods taught by the researcher with additional classroom teacher reinforcement. These encoding and oral reading fluency skills of first grade students using the Bob Jones Press basal reading program were affected depending upon one of two treatments of classroom instruction received: (1) classroom reading program with no supplemental students were evaluated using a combination of researcher-created and professionally developed pretests and posttests in order to examine differences in achievement between the two groups in decoding, which was measured by word attack (nonsense words) and word identification (real words) subtests, as well as encoding and oral reading fluency.

Restatement of Research Questions

This study attempts to answer the following questions related to the inclusion of supplemental multisensory instruction correlated with the classroom basal reading curriculum:

1. Does supplemental multisensory instruction improve overall student performance in decoding, encoding and oral reading fluency of first grade students as measured by a pretest and posttest?
2. Does supplemental multisensory instruction improve performance in decoding, encoding and oral reading fluency of first grade students in the bottom 50th percentile of total reading scores on the Stanford Achievement Test within the BJA first grade as measured by a pretest and posttest?
3. Does supplemental multisensory instruction improve performance in decoding, encoding and oral reading fluency of first grade students in the top 50th percentile

of total reading scores on the Stanford Achievement Test within the BJA first grade as measured by a pretest and posttest?

Restatement of Null Hypotheses

Ho1: Among all first grade students, there is no significant difference in the improvement scores on the decoding word identification (real word) subtest, as measured by the pretest and posttest, between those students receiving classroom reading instruction only (control group) and those receiving classroom instruction supplemented with multisensory methods taught by the researcher and reinforced by the classroom teacher (treatment group).

Ho2: Among all first grade students, there is no significant difference in the improvement scores on the decoding word attack (nonsense word) subtest, as measured by the pretest and posttest, between those students receiving classroom reading instruction only (control group) and those receiving classroom instruction supplemented with multisensory methods taught by the researcher and reinforced by the classroom teacher (treatment group).

Ho3: Among all first grade students, there is no significant difference in the improvement scores of words spelled correctly on the encoding subtest, as measured by the pretest and posttest, between those students receiving classroom reading instruction only (control group) and those receiving classroom instruction supplemented with multisensory methods taught by the researcher and reinforced by the classroom teacher (treatment group).

Ho4: Among all first grade students, there is no significant difference in the improvement scores of phonics points on the encoding subtest, as measured by the pretest and posttest, between those students receiving classroom reading instruction only (control group) and those receiving classroom instruction supplemented with multisensory methods taught by the researcher and reinforced by the classroom teacher (treatment group).

Ho5: Among all first grade students, there is no significant difference in the improvement scores on the DIBELS Oral Reading Fluency subtest, as measured by the pretest and posttest, between those students receiving classroom reading instruction only (control group) and those receiving classroom instruction supplemented with multisensory methods taught by the researcher and reinforced by the classroom teacher (treatment group).

Ho6: Among the bottom 50^{th} percentile of students, relative to their peers, within each BJA first grade class on the Stanford Achievement Test total reading scores, there is no significant difference in the improvement scores on the decoding word identification (real word) subtest, as measured by the pretest and posttest, between those first grade students receiving classroom reading instruction only (control group) and first grade students receiving classroom instruction supplemented with multisensory methods taught by the researcher and reinforced by the classroom teacher (treatment group).

Ho7: Among the bottom 50^{th} percentile of students, relative to their peers, within each BJA first grade class on the Stanford Achievement Test total reading scores, there is no significant difference in the improvement scores on the decoding word attack (nonsense word) subtest, as measured by the pretest and posttest, between those first grade students receiving classroom reading instruction only (control group) and first grade students receiving classroom instruction supplemented with multisensory methods taught by the researcher and reinforced by the classroom teacher (treatment group).

Ho8: Among the bottom 50th percentile of students, relative to their peers, within each BJA first grade class on the Stanford Achievement Test total reading scores, there is no significant difference in the improvement scores of words spelled correctly on the encoding subtest, as measured by the pretest and posttest, between those first grade students receiving classroom reading instruction only (control group) and first grade students receiving classroom instruction supplemented with multisensory methods taught by the researcher and reinforced by the classroom teacher (treatment group).

Ho9: Among the bottom 50th percentile of students, relative to their peers, within each BJA first grade class on the Stanford Achievement Test total reading scores, there is no significant difference in the improvement scores of phonics points on the encoding subtest, as measured by the pretest and posttest, between those first grade students receiving classroom reading instruction only (control group) and first grade students receiving classroom instruction supplemented with multisensory methods taught by the researcher and reinforced by the classroom teacher (treatment group).

Ho10: Among the bottom 50th percentile of students, relative to their peers, within each BJA first grade class on the Stanford Achievement Test total reading scores, there is no significant difference in the improvement scores on the DIBELS Oral Reading Fluency subtest, as measured by the pretest and posttest, between those first grade students receiving classroom reading instruction only (control group) and first grade students receiving classroom instruction supplemented with multisensory methods taught by the researcher and reinforced by the classroom teacher (treatment group).

Ho11: Among the top 50th percentile of students, relative to their peers, within each BJA first grade class on the Stanford Achievement Test total reading scores, there is no significant difference in the improvement scores on the decoding word identification (real word) subtest, as measured by the pretest and posttest, between those first grade students receiving classroom reading instruction only (control group) and first grade students receiving classroom instruction supplemented with multisensory methods taught by the researcher and reinforced by the classroom teacher (treatment group).

Ho12: Among the top 50th percentile of students, relative to their peers, within each BJA first grade class on the Stanford Achievement Test total reading scores, there is no significant difference in the improvement scores on the decoding word attack (nonsense word) subtest, as measured by the pretest and posttest, between those first grade students receiving classroom reading instruction only (control group) and first grade students receiving classroom instruction supplemented with multisensory methods taught by the researcher and reinforced by the classroom teacher (treatment group).

Ho13: Among the top 50th percentile of students, relative to their peers, within each BJA first grade class on the Stanford Achievement Test total reading scores, there is no significant difference in the improvement scores of words spelled correctly on the encoding subtest, as measured by the pretest and posttest, between those first grade students receiving classroom reading instruction only (control group) and first grade

students receiving classroom instruction supplemented with multisensory methods taught by the researcher and reinforced by the classroom teacher (treatment group).

Ho14: Among the top 50th percentile of students, relative to their peers, within each BJA first grade class on the Stanford Achievement Test total reading scores, there is no significant difference in the improvement scores of phonics points on the encoding subtest, as measured by the pretest and posttest, between those first grade students receiving classroom reading instruction only (control group) and first grade students receiving classroom instruction supplemented with multisensory methods taught by the researcher and reinforced by the classroom teacher (treatment group).

Ho15: Among the top 50th percentile of students, relative to their peers, within each BJA first grade class on the Stanford Achievement Test total reading scores, there is no significant difference in the improvement scores on the DIBELS Oral Reading Fluency subtest, as measured by the pretest and posttest, between those first grade students receiving classroom reading instruction only (control group) and first grade students receiving classroom instruction supplemented with multisensory methods taught by the researcher and reinforced by the classroom teacher (treatment group).

Acquisition of Permission

Permission to conduct the study was secured via personal communication by Dr. Dan Barbrow, principal at the elementary school at Bob Jones Academy and Mrs. Patty Fitzgerald, the primary center (grades K4 through 2) supervisor. The four participating first grade teachers also consented to be part of the study via personal communication. A meeting was held between the researcher, administration, and teachers of the treatment groups in the spring of the 2012-2013 school year to discuss scheduling considerations and implementation of the study for the following year. An outline of the study was given to each person with discussion as to the potential timeline for the study to take place in the classrooms (see Appendix A- *Dissertation Study Plan*). The researcher also described the multisensory techniques and methods that would be used in the classrooms and explained how they relate to the current reading curriculum. The administration and participating teachers were all in agreement on the timeline and format of the intended study within the first grade classrooms. Dr. Barbrow asked the researcher, and the researcher agreed, to attend each first grade open house meeting during the fall of the 2013-2014 school year to inform parents of the study. During the open house, a brief explanation of the study was given describing the intention to measure student response to supplemental multisensory methods of phonics instruction added in to the reading program. Parents were assured that each child's information would be kept anonymous and that there would not be any instruction taken away from the current curriculum as part of this study. They were also informed of their right to opt their child out of the research-specific assessments by signing and returning the *Request to Opt-Out of Research Study Assessments* form (see Appendix B).

Description and Selection of Population and Sample

The sample population includes first grade students in four classes at Bob Jones Academy in Greenville, South Carolina. There are a total of four classes in the first grade averaging between seventeen and twenty students per class with similar overall class averages on standardized achievement test scores. The two classes that comprised the treatment group were chosen based on teacher-expressed interest in the integration of supplemental multisensory methods within the existing curriculum. The other two first grade classes made up the control group.

The students in this study attend a Christian school that seeks to integrate a biblical worldview within all subject matter. Bob Jones Academy has high standards for student conduct including respect, attentiveness, punctuality, and hard work. While student demographics coupled with the school's learning environment provide rich educational opportunities, the focus of this study was to examine the extent to which students' reading skills improved a result of the experimental instructional intervention in relation to students without the experimental intervention.

Research Design

Methods within the Design

"Experimental designs provide the strongest, most convincing arguments of the causal effect of the independent variable because they control for the most sources of internal validity" (McMillan & Schumacher, 2010, p. 278). Within educational research, studies are often conducted on in-tact classes which limit some of the strength of the true experimental design due to the lack of randomization of subjects. This research study is a quasi-experimental pretest-posttest control design, using treatment and control groups, which is a strong alternative structure that controls for most sources of invalidity (McMillan & Schumacher, 2010). The use of a pretest-posttest control design provides the advantage of measuring improvement that students gain as a result of the intervention.

All students within the sample population were given four separate pretests and four separate posttests. The pretests included: two decoding subtests—one that assessed word identification using commonly understood real words (*word identification* subtest), and one that assessed the ability to connect letter(s) with sounds by decoding nonsense words (*word attack* subtest); an encoding subtest measuring both: phonics points (use of appropriate phonics rules for spelling words) and words spelled correctly; and a subtest that assessed oral reading fluency (the DORF subtest). The posttests were similar in format to the pretests and covered the three same areas of study (decoding, encoding and oral reading fluency), but were variations on the pretest in order to eliminate recognition of the pretest words.

This study included one treatment group and one control group. The treatment group consisted of two first grade classes at Bob Jones Academy and the control group consisted of the other two first grade classes. The two classes within the control group received daily instruction from the BJ reading curriculum without any multisensory supplemental instruction. The two classes within the treatment group also received daily instruction from the Bob Jones Press reading curriculum that the researcher supplemented with multisensory instructional methods for 15-20 minutes, three times a week for 12 weeks. The treatment group classroom teachers also reinforced the multisensory methods introduced by the researcher using an implementation checklist with specific instructions as to methods and time allowances for this reinforcement (see Appendix C). All four classroom teachers covered the phonics skills in the order and within the time frame prescribed in the BJ reading curriculum scope and sequence. This ensured that all four classes (treatment and control) were taught the same lesson from the BJ reading curriculum on the same day.

The researcher's intervention involved supplementing the teaching of the phonics-curriculum concepts from the scope and sequence by using multisensory encoding and decoding instruction that included a kinesthetic-tactile component. Decoding instruction consisted of drilling sounds, blending individual phonemes to form words, using finger-tapping and touching letter tiles as sounds are given, and reading words from word cards. Encoding instruction consists of segmenting individual phonemes within words and correctly associating the letter(s) with these phonemes through kinesthetic-tactile methods of finger-tapping, writing, and forming letter tiles.

The classroom teachers reinforced the (VAKT) methods that focused on both decoding and encoding, by following the implementation checklist mentioned above (see Appendix C). The decoding reinforcement activities included working on individual grapheme-phoneme (letter-sound) correspondences through a daily drill of letters, their associated keywords, and the sounds they make. Encoding instruction was reinforced by the teacher saying the word, students repeating and tapping out the sounds in the word and then writing the word either in the air or on a gel board. A more detailed description of the multisensory methods used by the researcher and the classroom teachers is provided below in the "Description of Supplemental Multisensory Instruction."

Sample Population Confidentiality and Reliability of the Design

All student data was kept confidential by assigning each student a code number that was unknown to the researcher. Records were divided by class, and by above and below 50th reading percentile within each class (as determined by results from the prior year's Stanford Achievement test total reading scores). Since the DORF (oral reading fluency) subtest, the decoding word identification (real word) subtest and the decoding word attack (nonsense word) subtest must be assessed by the person administering the test as the test is proceeding, the researcher did not administer or score these tests in order to eliminate research bias. Inter-rater reliability of these individually administered tests was established through the pilot study. The encoding subtest was administered by the classroom teachers and directions were given following a scripted format. Because the actual scoring of the encoding subtest required advanced knowledge of phonics concepts that were be taught during the study, the researcher scored each test. However, prior to scoring, a separate evaluator removed personal information from each individual test (i.e., student names) and assigned a code number that was unknown to the researcher. The separate evaluator also kept a list as to which group (treatment or control) each test came from and those codes within each group that fall in the above 50th reading percentile and the below 50th reading percentile. After all tests were scored, the separate evaluator grouped each code number with its associated test score according to treatment or control group, and within those groups, according to which percentile (below 50th or above 50th on the Stanford Achievement test total reading score) the code number belonged, for the researcher to analyze the data. This process helped eliminate any research bias.

The encoding subtest as well as the decoding word identification (real word) and decoding word attack (nonsense word) subtests were created by the researcher. Test validity for each of these was confirmed by an expert panel of three experienced first grade teachers who have taught the same phonics concepts that will be covered in the study, as well as two reading professionals with advanced degrees who are teaching on the university level. The split-halves method (even-odd) was also used to determine the reliability of the test.

Description of Bob Jones Press Phonics and Reading Program

The Bob Jones Press first grade reading program consists of six basal readers that increase in difficulty throughout the year. The reading program also has a phonics curriculum that is aligned with the basal readers. This phonics curriculum teaches students to identify the common phonograms, a letter or combination of letters that represent a sound, within words. They use word families containing words that end in similar phonograms to help students practice identifying the similar phonogram and reinforcing the particular sound within words. For example, after the phonogram –ick is taught, students will practice reading through words such as *sick, tick*, and *lick*. Reinforcement includes reading through word family lists, completing worksheets, reading stories in the basal readers, and participating in learning center activities.

Description of Supplemental Multisensory Instruction

The multisensory instruction followed a format similar to what is used in the Wilson Reading Series curriculum. The researcher's lessons, as well as the classroom teachers' reinforcement lessons were divided into two sections: encoding and decoding. Encoding is the ability to hear a sound(s) and identify the appropriate letter(s) that matches the sound(s). Decoding is the ability to recognize a letter(s) and identify the appropriate sound(s) that it makes.

The difference between the methods used in this study and the Wilson method is that the sequence and time frame of skills taught during this study directly aligned with the skills that were taught and applied in the BJ phonics and reading curriculum scope and sequence as opposed to the Wilson scope and sequence, which teaches these phonics skills in a different order. Additionally, the methods used within this study were a segment of the methods that are used within the Wilson method. The specific multisensory methods of instruction were chosen with the intent of maximizing understanding and reinforcement of letter-sound associations for all students within the regular classroom during the limited time frame available for the intervention. Each of the researcher's lessons included one or more elements from the decoding sections and one or more elements from the encoding section and were taught for the time frames listed beside the methods below.

The decoding section consisted of five elements:

1. *Letter name and sound recognition (one minute).* Students gave the name/keyword/sound for each color-coded sound card that was shown. These sounds were introduced in the same order as those in the BJ Phonics curriculum. Two formats for this skill instruction were used. First, students went through a quick drill of the sound cards in the beginning of each lesson. Second, the researcher recited a letter(s) name to the students, who then repeated the name and pulled out the corresponding letter(s) tile(s) from their magnetic letter boards.

2. *Blending sounds to form words (two minutes).* In initial lessons, students segmented sounds within a word using a finger-tapping procedure. The researcher used sound cards to spell a word, which included phonics skills from the current and previous lessons, on the dry-erase board. Students practiced tapping out these sounds and reading the entire word.

3. *Reading Words (2-8 minutes depending on the activity).* Students read words containing word structure elements from current and previous lessons. Although students went through a quick drill each day in order to apply knowledge of phonics rules to the reading of words, they also did a variety of other activities related to analyzing word structure using word cards.

The encoding section consisted of three elements:

1. *Letter name and sound recognition (in reverse) (two minutes).* The researcher gave the sound and students identified corresponding letter(s) using color-coded cards or tiles from their magnetic letter boards

2. *Blending sounds to form words (in reverse) (five minutes)*. The researcher dictated to the students three to five words (real or nonsense) that reflected phonics skills from current and previous lessons. The students repeated each word, tapped out the sounds within each word, and pulled out the corresponding letter tiles.

3. *Written work (five to ten minutes).* This aspect of encoding instruction was taught in two formats. First, the researcher dictated three to five sounds that corresponded with letter-sound association phonics rules taught during the study.

Students repeated the sound and wrote the letters for these sounds. Second, the researcher dictated to the students three to five words containing phonics skills from current and previous lessons in order to analyze word structure. The students repeated the word, tapped out the sound within that word, and wrote the word on a dry-erase board, composition paper, or gel board.

Test Instruments and Data Collection

Overview of Pre- and Posttests

As discussed in the research design section above, the format for the pretest-posttest instrument was divided into three categories: decoding, encoding, and oral reading fluency. The pretests and posttests were alternate forms of each other in order to reduce the possibility of students remembering content from one test to another. Reliability for the alternate forms was established through the split halves method (even-odd). The pretest-posttest design was used for two purposes. First, it was used to determine a baseline level of knowledge for each child's decoding, encoding, and oral reading fluency skills. This information was used to calculate the level of improvement gained in the posttest score comparison. Second, it was used to determine within-group variances based on the variables listed in the null hypotheses.

Decoding subtests. To assess decoding skills, the researcher developed a word identification subtest and a word attack subtest. The purpose for choosing a researcher-developed test was to provide a more precise assessment of how well students mastered specific classroom curriculum phonics skills that were taught during the study. Words within the test were placed in the order in which they were taught during the study, meaning that the first few words on the test contained phonics rules covered at the beginning of the study, with the last few words containing phonics rules that covered at the end of the study.

Word identification subtest. The word identification subtest involved each student's timed ability to decode isolated, commonly-understood (real) words (see Appendix E). Measurement of a student's isolated word knowledge is considered a reliable indicator of a student's oral reading rate. Morris et al. (2010) conducted a study to test the validity of timed word recognition assessments in predicting oral reading rate. The results showed a significant correlation ($p < .05$). In the present study, the researcher-created word identification subtest containing words that tested phonics skills taught progressively throughout the study.

Evaluation of word identification subtest responses. Students were evaluated by the amount of complete words read correctly within a one-minute time sample. If the student hesitated more than 3 seconds, the evaluator scored the word as incorrect and instructed the student to read the next word.

Word attack (nonsense word) subtest. The word attack subtest measured the student's ability to decode nonsense words (see Appendix E). Using nonsense words forces students to rely upon their understanding and application of the phonics rules they have been taught in order to sound out the words. Since the students were completely unfamiliar with these words, they could not rely on sight or previous familiarity of those words in the process of decoding. The ability, then, to translate nonsense words into sounds "indicates the presence of a unique process for recognizing printed forms-that is, assembling the pronunciation of a letter string by applying knowledge of typical correspondences between grapheme units and sounds" (Schrank, Wendling, & Woodcock, 2008, p. 26). This researcher-created subtest was similar in format to the Dynamic Indicators of Basic Early Literacy (DIBELS) Nonsense Word Fluency (NWF) subtest. Established reliability for this DIBELS subtest for first grade is .83. The criterion-validity of the DIBELS NWF with the Woodcock-Johnson Psycho-Educational Battery-Revised Readiness Cluster scores is .59 for the middle of first grade (Good & Kaminski, 2002).

Evaluation of word attack (nonsense word) subtest responses. According to the DIBELS scoring guidelines, the benchmark goal for middle first grade students is 50 correct letter sounds per minute. In this researcher-created subtest, students were presented with a list of nonsense words containing phonics rules that for the pretest, had not yet been taught but would be taught during the course of the study, and, for the posttest, had been taught during the study. The students were asked to verbally produce the individual letter sound (or letter clusters) or read the entire nonsense word. For example, if the student was presented with the word "lin" the student could say /l/ /i/ /n/, or say the word "lin" and receive credit for all three sounds (3/3). On the evaluator's form, each word was color-coded according to the amount of phonemes in that particular word (see Appendix D). Scores were based on whether the student correctly sounded out each phoneme in that word; and thus partial credit could be awarded for each word. Similar to the previous example of the nonsense word "lin," if the student pronounced it as /l/ /i/ /m/, then the student only received credit for identifying the /l/ and /i/ sounds and received a score of 2/3. After one-minute, the evaluator placed a line under the last word read, but each student continued reading until either the whole list had been read or a ceiling of five consecutive wrong answers (measured by incorrect reading of the nonsense word) was reached, whichever came first. This enabled the researcher to evaluate the timed reading of nonsense words *and* measure the level of decoding ability in relationship to the phonics skills that were covered within this list. However, student scores were only reported on the amount of phonemes they read until mispronouncing five consecutive words. Five consecutive wrong answers is a common stopping point for diagnostic evaluations such as the Woodcock Reading Mastery Test and the Brigance Diagnostic Comprehensive Inventory of Basic Skills (Woodcock, 2011; Brigance, 1999). Insertions and self-corrections were ignored. Hesitations of more than three seconds were scored as incorrect. The total amount of phonemes in each word for the entire test were tabulated and student scores reflected how many phonemes were correctly identified.

Validity and reliability of decoding (word identification and word attack) subtests. The researcher-created decoding subtests were reviewed by a panel of three experts in the field of lower elementary reading in order to establish the tests' validity. Each individual on this panel has taught these BJ phonics rules from the reading curriculum for over 8 years and is knowledgeable in her understanding of the phonics rules contained in the words within these decoding subtests. Because the researcher supplemented and the classroom teachers reinforced phonics concepts that were already being taught with the current curriculum, the words on these decoding assessments contained the same phonics rules that were addressed in the BJ Reading curriculum scope and sequence. It is important to note that standards in this curriculum are aligned in similar format with state and national standards. According to the BJ Press website (2014),

> BJ Press has consulted national and state standards when developing new textbooks and revising previous editions. Many BJU Press textbooks include charts that illustrate our adherence to national standards wherever possible. We often consult the standards from the "big three" states- Florida, California, and Texas- in addition to consulting standards from other states that are viewed highly for their standards in a particular content area.

The panel compared each word in these decoding subtests with the BJ Reading curriculum scope and sequence to confirm that the assessments would cover those skills taught during the study. Consistency of measurement reliability for all subtests was established through its administration to ten first grade students in the pilot study. A separate split-halves method was conducted on both alternate forms and compared to determine content reliability of both tests. Data analysis was conducted using SPSS software, and Spearman Brown Coefficient was used to determine the correlation coefficient.

Encoding subtest. The second category of evaluation involves a measurement of encoding ability (see Appendix F). Encoding, which is very similar to spelling, requires the ability to discern language by segmenting sounds (phonemes) and translating them to letters (graphemes). The Woodcock-Johnson III Test of Achievement (WJ III) evaluates student ability to map sounds to letters through an encoding (spelling) test containing nonsense words. The difference between the WJ III and the researcher-created subtest is that real words were used for the researcher-created encoding subtest and those words only contained phonics rules taught during the study. Each encoding test was administered by the classroom teachers. Student response sheets were collected by an alternate evaluator who assigned each student a code number unknown to the researcher in order to prevent possible bias during researcher-scoring of student results. Similar to the word identification and word attack subtests, the encoding pretest and posttest were alternate forms evaluating the same skills.

Evaluation of encoding subtest responses. Because systematic and explicit multisensory language instruction involves the study of word patterns and the reciprocal relationship between decoding and encoding (Weiser, 2010), the following format for the encoding evaluation form was chosen to reflect this understanding. The researcher created a table similar in format to the Words Their Way Elementary Spelling Inventory (Bear et al., 2008) in order to evaluate students' abilities to spell each word correctly and their knowledge of word patterns taught during the study.

In the same way as the Words their Way evaluation form, the researcher-created evaluation form assessed student understanding of phoneme-grapheme relationships using invented and developmental spelling knowledge. It did so by separating each word into its individual phonemic and spelling components. These components, which correspond with the phonics and spelling skills that were taught during the study, were placed on a grid across the top of the form. Evaluation consisted of the following letter-sound association skills and measured understanding of the following spelling rules: beginning sounds, short vowels, final sounds, blends, digraphs, glued sounds, long vowels, diphthongs, consonant-le sounds, suffixes, doubled consonants, soft c/soft g, r-controlled, and trigraphs. Student scores were separated into two separate components on this test. The first component consisted of words that were spelled correctly. The second component consisted of the individual phonemic elements within each word (called "phonics points" on the subtest). Students were given credit for applying the correct phonics rule to the word even if the word was spelled incorrectly. For example, the word "fight" contains three separate phonemic components: /f/, /ī/, /t/. The student received full phonics points credit for spelling this word as "fight" or "fite" because correct phonics rules were used to spell the word.

Validity and reliability of encoding subtest. According to Pearson Instructional Resources (2013), the Words Their Way spelling program is now listed as part of an "Instructional Intervention Tool on the National Center on Response to Intervention (NCRTI) website" (p. 1). Sterbinsky (2007) conducted a study to determine validity and reliability for the elementary-age version of Words Their Way Spelling Inventory, which is similar in format to the researcher-created encoding subtest. Eight hundred sixty-two students were evaluated. According to Sterbinsky (2007), "examination of the internal consistency of the instrument yielded an overall reliability coefficient of .915 (Cronbach's alpha)" (p. 9). Test-retest reliabilities ranged from .931 to .974 and were statistically significant at the $p<.001$ level.

Validity for the researcher-created test and evaluation form was established by the same expert panel of three professionals in the field of lower elementary reading that reviewed the decoding subtest. Each word on the pretest and its variation on the posttest and the scoring guidelines for those words on the evaluation form were carefully compared to the word study skills that are covered in the BJ Reading curriculum scope and sequence to determine that skills assessed were those that were taught during the study. The encoding subtest pretest and posttest were administered by the classroom teachers. Directions were administered following a scripted format similar to the recommendations of the Words Their Way scripted instructions (see Appendix M). Because the actual scoring of the encoding subtest required advanced knowledge of phonics concepts that were taught during the study, the researcher scored each test.

Prior to scoring, a separate evaluator removed personal information (i.e., student names) from each individual test and assigned each student a code number unknown to the researcher. The separate evaluator kept a list as to the assigned code number for each student, and whether the student was in the treatment or control group. During the scoring process, the researcher did not know whether the test came from the treatment group or the control group. After all tests were scored and prior to data analysis by the researcher, the separate evaluator grouped each code number with its associated test score according to treatment or control group, and within those groups, whether each student was in the below 50th or the above 50th percentile relative to their peers on the Stanford Achievement Reading Test. This process helped to eliminate any research bias.

Consistency of measurement reliability for the subtest was established through its administration to ten first grade students in the pilot study. Separate split-halves method was conducted on both pretest and the alternate-form posttest and compared to determine reliability of both tests. Data analysis was conducted using SPSS software, and Spearman Brown Correlation Coefficient was used to determine the correlation coefficient.

Oral Reading Fluency Subtest. The third category of evaluation involved a measurement of each student's ability to accurately decode (read) connected text. With application to reading, the skill most often measured to indicate reading proficiency is oral reading fluency. A reliable indicator of student reading fluency is the assessment of how many words are read correctly in a one-minute oral reading sample (Deno, 1982; Morris et al., 2010; Fuchs & Fuchs, 1999). The posttest reading sample was a variation on the pretest reading sample, testing the same phonics skills that were covered during the study.

Evaluation of the oral reading fluency subtest assessment. Students were assessed in this format using the DIBELS Oral Reading Fluency (DORF) assessment, which is a standardized, individually administered test of accuracy and fluency of connected text. The DORF assessment measured how well a student read aloud a passage for a one-minute time period. All omissions, substitutions, and hesitations of more than three seconds were considered errors. Self-corrections within three seconds were considered accurate. The oral reading rate was the number of words read correctly from the passage in one-minute. Each student read three passages. Each passage was read for one-minute and scored separately. The average of the three scores was taken as a marker of the student's oral reading fluency ability.

Validity and reliability of oral reading fluency subtest. DORF assessments are modeled after the Curriculum-Based Measurement (CBM) of reading, which is a form of progress monitoring assessments. These tests use a prescriptive form of measurement procedures (Stecker, Fuchs & Fuchs, 2005) and are used to assess student progress towards end of the year objectives rather than just measuring the short-term skills that the student has learned. The DORF has twenty alternate oral reading fluency passages for first grade. Test-retest reliabilities of CBM reading measures using alternate forms of different reading passages assessing the same level ranged from .89 to .94. Additionally, eight different studies using DORF CBM reading measures reported coefficients ranging from .52 to .91 (Good & Kaminski, 2002).

Validity was established by testing the readability estimates. The Spache readability estimate was used to "revise and refine reading passages . . . because a second-grade analysis of the relation between readability formulas and empirical pattern of children's reading found the most support for the SPACHE formula" (Good & Kaminski, 2002, p. 2). Therefore, using this readability formula, alternate form passages were revised and refined to precisely measure fluency of skills to be taught during the study.

Data Analysis of Study Assessments

An analysis of data was conducted during the spring of the 2013-2014 school year, following the intervention study in the classrooms. Pretest and posttest assessments for the encoding subtests were scored by the researcher, while pretest and posttest assessments for the decoding word identification and word attack subtests, as well as the oral reading fluency subtests were scored by two separate evaluators. Student scores on the decoding word identification subtest were based upon the total number of words read within a one-minute timed sample. Student scores on the decoding word attack subtest were calculated by the amount of phonemes pronounced within each word until five consecutive words were read incorrectly. Student scores on the encoding skills subtest components, "words spelled correctly" and "phonics points," were calculated using the evaluation guide established by the researcher (see Appendix F). Student scores on the DORF were calculated by the answer key established in the instrument. The data was entered into the Statistical Package for the Social Sciences (SPSS) statistical software to analyze and test the null hypotheses.

Content validity for the decoding word attack and word identification subtests as well as the encoding researcher-created subtests, was created using the Spearman Brown Coefficient. An independent samples t-test for null hypotheses one through five, was used to determine significant difference in improvement scores between the pre- and posttest assessment on group means for the decoding word identification, decoding word attack, encoding, and oral reading fluency evaluations.

Pilot Study

The researcher conducted a pilot study in order to determine appropriate reliability of instrument measures and to test statistical analysis procedures for measuring student differences. The independent variable was the teaching methods and included two levels: classroom curriculum reading instruction only for the control group and classroom curriculum reading instruction supplemented with multisensory instruction by the researcher and reinforced by the classroom teachers for the treatment group. The dependent variable was improvement scores from pretest to posttest on the following four subtests: decoding word identification, decoding word attack, encoding, and oral reading fluency. The pilot study included the improvement scores on each of the four subtests from 10 first grade students, five of which were in the treatment group and five of which were in the control group.

Reliability for Researcher-Created Subtests

Content reliability. Statistical correlation coefficients were run for the three researcher-created subtests used in the pilot study: decoding word identification, decoding word attack, and encoding. Because each subtest had an alternate form, data was analyzed on both pretest and posttest for each of these three subtests. According to Hinkle, Wiersma, and Jurs (2003) the rule of thumb is .70 - .90 for high positive correlation and .90 + for very high positive correlation when establishing content reliability. The data analysis of the Spearman Brown Coefficient yielded .829 for the pretest and .950 for the posttest indicating strong content reliability (see Appendix G). The data analysis for the decoding word attack subtests yielded .882 for the pretest and .845 for the posttest, which also indicates acceptable content reliability (see Appendix H). The data analysis for the encoding subtests yielded .854 for the pretest and .752 for the posttest (see Appendix I). Therefore, content validity was established for all three researcher-created subtests.

Inter-rater reliability. Two evaluators conducted the study assessments for three of the subtests: decoding word identification, decoding word attack, and oral reading fluency. Statistical correlation was conducted using Interclass Correlation Coefficient in SPSS. Average measures for the word identification pretest were 0.980 and the posttest was 0.995 (see Appendix J). Average measures for the decoding word attack pretest were 0.997 and the posttest was 0.996 (see Appendix K). Average measures for the oral reading fluency pretest were 0. 997 and the posttest was 0.999 (see Appendix L). According to Landis and Koch (1977), 0.81-1.0 is an 'almost perfect' agreement. Therefore, inter-rater reliability for all three subtests was established through the pilot study.

Data Analysis for the Pilot Study

An analysis of the data for the decoding word identification subtest indicated that there was no significant difference in the constructed mean scores between the treatment and control groups (see Appendix O). However, the equality of means approached significance at $p = .058$. The null hypothesis stating there was no significant difference between the treatment and control group in decoding word identification skills was accepted. The decoding word attack subtest yielded a $p = .140$ (see Appendix P). Therefore, the null hypothesis stating there was no significant difference between the treatment and control group in the decoding word attack subtest was also accepted. Analysis of the encoding data also revealed no significant differences between the two groups. The encoding test words spelled correctly component yielded $p=.140$ and the phonics points component yielded $p=.488$ (see Appendix Q). Both null hypotheses stating there were no significant differences between the two groups in encoding skills were accepted. The oral reading fluency test yielded a p=.139 indicating there was no significant difference between the two groups (see Appendix R). The null hypothesis, which there was no significant difference between the two groups in oral reading fluency skills, was accepted. All statistical analysis were set at the .05 level of significance and equal variances were assumed for each subtest.

Sample Size for Study

Four factors must be considered when determining sample size: the level of significance, the power of the test, the standardized effect size, and the treatment levels. Using table C.12. from Hinkle, Wiersma, and Jurs, (2003, p. 655) the following values were used to establish sample size for this dissertation study:

- The level of significance (α)= .05
- The power of the test = .75
- The standardized effect size= 1.0 σ^2
- Treatment levels (k)= 2

The appropriate sample size for this study would be a minimum of 15 students.

CHAPTER IV

ANALYSIS OF STUDY DATA

The analysis of study data is drawn from the following sections: (a) restatement of the problem, (b) restatement of research questions, (c) restatement of null hypotheses, (d) description of the sample, (e) experiment and data collection procedure, and (f) testing of the null hypotheses.

Restatement of the Problem

The purpose of this study was to determine whether and to what extent the decoding, encoding and oral reading fluency skills of first grade students using the Bob Jones Press basal reading program were affected depending upon one of two treatments of classroom instruction received: (1) classroom reading program with no supplemental reinforcement, and (2) classroom reading program supplemented with multisensory methods taught by the researcher with additional classroom teacher reinforcement. These students were evaluated using a combination of researcher-created and professionally-developed pretests and posttests in order to examine differences in achievement between the two groups in decoding, which was measured by word identification (real words) and word attack (nonsense words) subtests, as well as encoding and oral reading fluency.

Restatement of Research Questions

This study attempted to answer the following questions related to the inclusion of supplemental multisensory instruction correlated with the classroom basal reading curriculum:

1. Does supplemental multisensory instruction improve overall student performance in decoding, encoding and oral reading fluency of first grade students as measured by a pretest and posttest?
2. Does supplemental multisensory instruction improve performance in decoding, encoding and oral reading fluency of first grade students in the bottom 50th percentile of total reading scores on the Stanford Achievement Test within the BJA first grade as measured by a pretest and posttest?
3. Does supplemental multisensory instruction improve performance in decoding, encoding and oral reading fluency of first grade students in the top 50th percentile of total reading scores on the Stanford Achievement Test within the BJA first grade as measured by a pretest and posttest?

Restatement of Null Hypotheses

Ho1: Among all first grade students, there is no significant difference in the improvement scores on the decoding word identification (real word) subtest, as measured by the pretest and posttest, between those students receiving classroom reading instruction only (control group) and those receiving classroom instruction supplemented with multisensory methods taught by the researcher and reinforced by the classroom teacher (treatment group).

Ho2: Among all first grade students, there is no significant difference in the improvement scores on the decoding word attack (nonsense word) subtest, as measured by the pretest and posttest, between those students receiving classroom reading instruction only (control group) and those receiving classroom instruction supplemented with multisensory methods taught by the researcher and reinforced by the classroom teacher (treatment group).

Ho3: Among all first grade students, there is no significant difference in the improvement scores of words spelled correctly on the encoding subtest, as measured by the pretest and posttest, between those students receiving classroom reading instruction only (control group) and those receiving classroom instruction supplemented with multisensory methods taught by the researcher and reinforced by the classroom teacher (treatment group).

Ho4: Among all first grade students, there is no significant difference in the improvement scores of phonics points on the encoding subtest, as measured by the pretest and posttest, between those students receiving classroom reading instruction only (control group) and those receiving classroom instruction supplemented with multisensory methods taught by the researcher and reinforced by the classroom teacher (treatment group).

Ho5: Among all first grade students, there is no significant difference in the improvement scores on the DIBELS Oral Reading Fluency subtest, as measured by the pretest and posttest, between those students receiving classroom reading instruction only (control group) and those receiving classroom instruction supplemented with multisensory methods taught by the researcher and reinforced by the classroom teacher (treatment group).

Ho6: Among the bottom 50th percentile of students, relative to their peers, within each BJA first grade class on the Stanford Achievement Test total reading scores, there is no significant difference in the improvement scores on the decoding word identification (real word) subtest, as measured by the pretest and posttest, between those first grade students receiving classroom reading instruction only (control group) and first grade students receiving classroom instruction supplemented with multisensory methods taught by the researcher and reinforced by the classroom teacher (treatment group).

Ho7: Among the bottom 50th percentile of students, relative to their peers, within each BJA first grade class on the Stanford Achievement Test total reading scores, there is no significant difference in the improvement scores on the decoding word attack (nonsense word) subtest, as measured by the pretest and posttest, between those first grade students receiving classroom reading instruction only (control group) and first grade students receiving classroom instruction supplemented with multisensory methods taught by the researcher and reinforced by the classroom teacher (treatment group).

Ho8: Among the bottom 50th percentile of students, relative to their peers, within each BJA first grade class on the Stanford Achievement Test total reading scores, there is no significant difference in the improvement scores of words spelled correctly on the encoding subtest, as measured by the pretest and posttest, between those first grade students receiving classroom reading instruction only (control group) and first grade

students receiving classroom instruction supplemented with multisensory methods taught by the researcher and reinforced by the classroom teacher (treatment group).

Ho9: Among the bottom 50^{th} percentile of students, relative to their peers, within each BJA first grade class on the Stanford Achievement Test total reading scores, there is no significant difference in the improvement scores of phonics points on the encoding subtest, as measured by the pretest and posttest, between those first grade students receiving classroom reading instruction only (control group) and first grade students receiving classroom instruction supplemented with multisensory methods taught by the researcher and reinforced by the classroom teacher (treatment group).

Ho10: Among the bottom 50^{th} percentile of students, relative to their peers, within each BJA first grade class on the Stanford Achievement Test total reading scores, there is no significant difference in the improvement scores on the DIBELS Oral Reading Fluency subtest, as measured by the pretest and posttest, between those first grade students receiving classroom reading instruction only (control group) and first grade students receiving classroom instruction supplemented with multisensory methods taught by the researcher and reinforced by the classroom teacher (treatment group).

Ho11: Among the top 50^{th} percentile of students, relative to their peers, within each BJA first grade class on the Stanford Achievement Test total reading scores, there is no significant difference in the improvement scores on the decoding word identification (real word) subtest, as measured by the pretest and posttest, between those first grade students receiving classroom reading instruction only (control group) and first grade

students receiving classroom instruction supplemented with multisensory methods taught by the researcher and reinforced by the classroom teacher (treatment group).

Ho12: Among the top 50th percentile of students, relative to their peers, within each BJA first grade class on the Stanford Achievement Test total reading scores, there is no significant difference in the improvement scores on the decoding word attack (nonsense word) subtest, as measured by the pretest and posttest, between those first grade students receiving classroom reading instruction only (control group) and first grade students receiving classroom instruction supplemented with multisensory methods taught by the researcher and reinforced by the classroom teacher (treatment group).

Ho13: Among the top 50th percentile of students, relative to their peers, within each BJA first grade class on the Stanford Achievement Test total reading scores, there is no significant difference in the improvement scores of words spelled correctly on the encoding subtest, as measured by the pretest and posttest, between those first grade students receiving classroom reading instruction only (control group) and first grade students receiving classroom instruction supplemented with multisensory methods taught by the researcher and reinforced by the classroom teacher (treatment group).

Ho14: Among the top 50th percentile of students, relative to their peers, within each BJA first grade class on the Stanford Achievement Test total reading scores, there is no significant difference in the improvement scores of phonics points on the encoding subtest, as measured by the pretest and posttest, between those first grade students receiving classroom reading instruction only (control group) and first grade students receiving classroom instruction supplemented with multisensory methods taught by the researcher and reinforced by the classroom teacher (treatment group).

Ho15: Among the top 50th percentile of students, relative to their peers, within each BJA first grade class on the Stanford Achievement Test total reading scores, there is no significant difference in the improvement scores on the DIBELS Oral Reading Fluency subtest, as measured by the pretest and posttest, between those first grade students receiving classroom reading instruction only (control group) and first grade students receiving classroom instruction supplemented with multisensory methods taught by the researcher and reinforced by the classroom teacher (treatment group).

Description of the Sample

There were two first grade classes in the treatment group and two first grade classes in the control group. There were 63 participants in the study, with 33 students in the treatment group and 30 in the control group. Students were categorized within the treatment and control group according to whether their individual scores on the reading subtest of the Stanford Achievement Test, relative only to their first grade peers at BJA, were above or below the 50th percentile. Given that there was an odd number of students within the treatment group, 16 students were above the 50th percentile and 17 were below, while within the control group the numbers above and below the 50th percentile were equal at 15 each. Tables 1 summarizes the participant demographics.

Table 1

Composition of Treatment and Control Groups

Group	Above 50th Percentile	Below 50th Percentile	Total
Control	16	17	33
Treatment	15	15	30

Experiment and Data Collection Procedures

Four pretests and four posttests were administered to all students as part of this study. These tests measured word identification, word attack (both of which measure decoding skills), encoding abilities, and oral reading fluency skills. The word identification, word attack, and oral reading fluency tests were individually administered by two separate evaluators. Inter-rater reliability for the two evaluators was established during the pilot study. The encoding tests were administered to each class as a group by their classroom teacher. Each classroom teacher followed a scripted format to maintain test administration consistency. The pretests were administered during the two weeks prior to the intervention and the posttests were administered during the two weeks following the intervention. Pretests and posttests were alternate forms of each other. Content reliability for both sets of tests was established through statistical analysis using the Spearman Brown Coefficient on student results following the pilot study. The pretests were administered to determine students' base level knowledge of their application of phonics rules to real words, nonsense words, spelling and connected texts.

The teachers participating in the treatment group met with the researcher for two hours prior to the start of the study to discuss classroom implementation by the researcher and additional supplemental instruction by the teachers. During the study the treatment group teachers met with the researcher once a week to discuss intervention implementation. Prior to the study's commencing, the researcher developed an implementation checklist that listed the supplemental intervention methods for the treatment group classroom teachers to follow. This checklist was given to the teachers each Monday. As the supplemental intervention methods were completed by the teachers during the week, they marked it on the checklist. Checklists were given back to the researcher each Friday and recorded.

Testing of the Null Hypotheses

Null Hypothesis One

Among all first grade students, there is no significant difference among all first grade student in the improvement scores on the decoding word identification (real word) subtest, as measured by the pretest and posttest, between those students receiving classroom reading instruction only (control group) and those receiving classroom instruction supplemented with multisensory methods taught by the researcher and reinforced by the classroom teacher (treatment group).

An independent samples t-test was conducted to test the null hypothesis. Table 2 shows the mean differences and standard deviations for the treatment and control group improvement scores from the pretest to the posttest. An analysis of the data reveals that there was a significant difference in favor of the treatment group, between the improvement scores of the treatment group and control group ($p = .000$). Thus, the null hypothesis that there is no significant difference in the improvement scores on the decoding word identification (real word) subtest is rejected. Results from this analysis are listed in Table 3.

Table 2

Descriptive Statistics for Ho1 Improvement Scores

Group	N	Mean Improvement	Standard Deviation
Control	30	2.93	6.69
Treatment	33	10.91	6.18

Table 3

Ho1 Decoding Word Identification Independent T-Test Results

Equality of Variance (Sig.)	t	df	Mean Difference	Std. Error Difference	*p*
.985	-4.92	61	-7.98	1.62	.000

Null Hypothesis Two

Among all first grade students, there is no significant difference in the improvement scores on the decoding word attack (nonsense word) subtest, as measured by the pretest and posttest, between those students receiving classroom reading instruction only (control group) and those receiving classroom instruction supplemented with multisensory methods taught by the researcher and reinforced by the classroom teacher (treatment group).

An independent samples t-test was conducted to test the null hypothesis. Table 4 shows the mean differences and standard deviations for the treatment and control group improvement scores from the pretest to the posttest. An analysis of the data reveals that there was a significant difference between the improvement scores of the treatment group and the control group ($p = .008$). Thus, the null hypothesis that there is no significant difference in the improvement scores on the decoding word attack (nonsense word) subtest is rejected. Results from this analysis are listed in Table 5.

Table 4

Descriptive Statistics for Ho2 Improvement Scores

Group	N	Mean Improvement	Standard Deviation
Control	30	12.90	26.08
Treatment	33	33.70	33.79

Table 5

Ho2 Decoding Word Attack Independent T-Test Results

Equality of Variance (Sig.)	t	df	Mean Difference	Std. Error Difference	*p*
.042	-2.75	59.49	-20.8	7.57	.008

Null Hypothesis Three

Among all first grade students, there is no significant difference in the improvement scores of words spelled correctly on the encoding subtest, as measured by the pretest and posttest, between those students receiving classroom reading instruction only (control group) and those receiving classroom instruction supplemented with multisensory methods taught by the researcher and reinforced by the classroom teacher (treatment group).

An independent samples t-test was conducted to test the null hypothesis. Table 6 shows the mean differences and standard deviations for the treatment and control group improvement scores from the pretest to the posttest. An analysis of the data reveals that there was a significant difference between the improvement scores of the treatment group and the control group (*p*= .000). Thus, the null hypothesis that there is no significant difference in the improvement scores of the words spelled correctly on the encoding subtest is rejected. Results from this analysis are listed in Table 7.

Table 6

Descriptive Statistics for Ho3 Improvement Scores

Group	N	Mean Improvement	Standard Deviation
Control	30	11.90	5.67
Treatment	33	19.36	7.02

Table 7

Ho3 Encoding (Words Spelled Correctly) Independent T-Test Results

Equality of Variance (Sig.)	t	df	Mean Difference	Std. Error Difference	*p*
.143	-4.61	61	-7.47	1.62	.000

Null Hypothesis Four

Among all first grade students, there is no significant difference in the improvement scores of phonics points on the encoding subtest, as measured by the pretest and posttest, between those students receiving classroom reading instruction only (control group) and those receiving classroom instruction supplemented with multisensory methods taught by the researcher and reinforced by the classroom teacher (treatment group).

An independent samples t-test was conducted to test the null hypothesis. Table 8 shows the mean differences and standard deviations for the treatment and control group improvement scores from the pretest to the posttest. An analysis of the data reveals that there was a significant difference between the improvement scores of the treatment group and the control group (p= .040). Thus, the null hypothesis that there is no significant difference in the improvement scores of the phonics points on the encoding subtest is rejected. Results from this analysis are listed in Table 9.

Table 8

Descriptive Statistics for Ho4 Improvement Scores

Group	N	Mean Improvement	Standard Deviation
Control	30	21.20	10.31
Treatment	33	27.85	14.28

Table 9

Ho4 Encoding (Phonics Points) Independent T-Test Results

Equality of Variance (Sig.)	t	df	Mean Difference	Std. Error Difference	*p*
.144	-2.10	61	-6.65	3.17	.040

Null Hypothesis Five

Among all first grade students, there is no significant difference in the improvement scores on the DIBELS Oral Reading Fluency subtest, as measured by the pretest and posttest, between those students receiving classroom reading instruction only (control group) and those receiving classroom instruction supplemented with multisensory methods taught by the researcher and reinforced by the classroom teacher (treatment group).

An independent samples t-test was conducted to test the null hypothesis. Table 10 shows the mean differences and standard deviations for the treatment and control group improvement scores from the pretest to the posttest. An analysis of the data reveals that there was not a significant difference between the improvement scores of the treatment group and the control group ($p = .060$). Thus, the null hypothesis that there is no significant difference in the improvement scores on the DIBELS Oral Reading Fluency subtest is accepted. Results from this analysis are listed in Table 11.

Table 10

Descriptive Statistics for Ho5 Improvement Scores

Group	N	Mean Improvement	Standard Deviation
Control	30	19.63	11.87
Treatment	33	25.76	13.34

Table 11

Ho5 DIBELS Oral Reading Fluency Independent T-Test Results

Equality of Variance (Sig.)	t	df	Mean Difference	Std. Error Difference	*p*
.619	-1.92	61	-6.12	3.19	.060

Null Hypothesis Six

Among the bottom 50th percentile of students, relative to their peers, within each BJA first grade class on the Stanford Achievement Test total reading scores, there is no significant difference in the improvement scores on the decoding word identification (real word) subtest, as measured by the pretest and posttest, between those first grade students receiving classroom reading instruction only (control group) and first grade students receiving classroom instruction supplemented with multisensory methods taught by the researcher and reinforced by the classroom teacher (treatment group).

An independent samples t-test was conducted to test the null hypothesis. Table 12 shows the mean differences and standard deviations of improvement scores in the treatment and control groups from the pretest to the posttest among the bottom 50th percentile of students, relative to their peers, within each BJA first grade class on the Stanford Achievement Test total reading scores. An analysis of the data reveals that there was a significant difference between the improvement scores of students within the bottom 50th percentile in the treatment group as compared to the control group ($p = .001$). Thus, the null hypothesis that there is no significant difference in the improvement scores on the decoding word identification (real word) subtest is rejected. Results from this analysis are listed in Table 13.

Table 12

Descriptive Statistics for Ho6 (Bottom 50th) Improvement Scores

Group	N	Mean Improvement	Standard Deviation
Control	15	4.00	5.72
Treatment	17	12.53	7.2.0

Table 13

Ho6 (Bottom 50th) Decoding Word Identification Independent T-Test Results

Equality of Variance (Sig.)	t	df	Mean Difference	Std. Error Difference	*p*
.268	3.68	30	-8.53	2.32	.001

Null Hypothesis Seven

Among the bottom 50th percentile of students, relative to their peers, within each BJA first grade class on the Stanford Achievement Test total reading scores, there is no significant difference in the improvement scores on the decoding word attack (nonsense word) subtest, as measured by the pretest and posttest, between those first grade students receiving classroom reading instruction only (control group) and first grade students receiving classroom instruction supplemented with multisensory methods taught by the researcher and reinforced by the classroom teacher (treatment group).

An independent samples t-test was conducted to test the null hypothesis. Table 14 shows the mean differences and standard deviations of improvement scores in the treatment and control groups from the pretest to the posttest among the bottom 50th percentile of students, relative to their peers, within each BJA first grade class on the Stanford Achievement Test total reading scores. An analysis of the data reveals that there was a significant difference between the improvement scores of students within the bottom 50th percentile in the treatment group and the control group (*p*= .014). Thus, the null hypothesis that there is no significant difference in the improvement scores on the decoding word attack (nonsense word) subtest is rejected. Results from this analysis are listed in Table 15.

Table 14

Descriptive Statistics for Ho7 (Bottom 50th) Improvement Scores

Group	N	Mean Improvement	Standard Deviation
Control	15	15.80	29.84
Treatment	17	47.94	38.28

Table 15

Ho7 (Bottom 50th) Decoding Word Attack Independent T-Test Results

Equality of Variance (Sig.)	t	df	Mean Difference	Std. Error Difference	*p*
.200	-2.62	30	-32.14	12.26	.014

Null Hypothesis Eight

Among the bottom 50th percentile of students, relative to their peers, within each BJA first grade class on the Stanford Achievement Test total reading scores, there is no significant difference in the improvement scores of words spelled correctly on the encoding subtest, as measured by the pretest and posttest, between those first grade students receiving classroom reading instruction only (control group) and first grade students receiving classroom instruction supplemented with multisensory methods taught by the researcher and reinforced by the classroom teacher (treatment group).

An independent samples t-test was conducted to test the null hypothesis. Table 16 shows the mean differences and standard deviations of improvement scores in the treatment and control groups from the pretest to the posttest among the bottom 50^{th} percentile of students, relative to their peers, within each BJA first grade class on the Stanford Achievement Test total reading scores. An analysis of the data reveals that there was a significant difference between the improvement scores students within the bottom 50^{th} percentile in the treatment group and the control group (*p*= .000). Thus, the null hypothesis that there is no significant difference in the improvement scores of words spelled correctly on the encoding subtest is rejected. Results from this analysis are listed in Table 17.

Table 16

Descriptive Statistics for Ho8 (Bottom 50^{th}) Improvement Scores

Group	N	Mean Improvement	Standard Deviation
Control	15	9.20	5.32
Treatment	17	20.12	6.58

Table 17

Ho8 (Bottom 50th) Encoding (Words Spelled Correctly) Independent T-Test Results

Equality of Variance (Sig.)	t	df	Mean Difference	Std. Error Difference	*p*
.254	-5.12	30	-10.92	2.13	.000

Null Hypothesis Nine

Among the bottom 50th percentile of students, relative to their peers, within each BJA first grade class on the Stanford Achievement Test total reading scores, there is no significant difference in the improvement scores of phonics points on the encoding subtest, as measured by the pretest and posttest, between those first grade students receiving classroom reading instruction only (control group) and first grade students receiving classroom instruction supplemented with multisensory methods taught by the researcher and reinforced by the classroom teacher (treatment group).

An independent samples t-test was conducted to test the null hypothesis. Table 18 shows the mean differences and standard deviations of improvement scores in the treatment and control groups from the pretest to the posttest among the bottom 50th percentile of students, relative to their peers, within each BJA first grade class on the Stanford Achievement Test total reading scores. An analysis of the data reveals that there was not a significant difference between the improvement scores students within the bottom 50th percentile in the treatment group and the control group (p= .061). Thus, the null hypothesis that there is no significant difference in the improvement scores of the phonics points on the encoding subtest is accepted. Results from this analysis are listed in Table 19.

Table 18

Descriptive Statistics for Ho9 (Bottom 50th) Improvement Scores

Group	N	Mean Improvement	Standard Deviation
Control	15	21.4	12.38
Treatment	17	30.41	13.65

Table 19

Ho9 (Bottom 50th Encoding (Phonics Points) Independent T-Test Results

Equality of Variance (Sig.)	t	df	Mean Difference	Std. Error Difference	*p*
.825	-1.95	30	-9.01	4.63	.061

Null Hypothesis Ten

Among the bottom 50th percentile of students, relative to their peers, within each BJA first grade class on the Stanford Achievement Test total reading scores, there is no significant difference in the improvement scores on the DIBELS Oral Reading Fluency subtest, as measured by the pretest and posttest, between those first grade students receiving classroom reading instruction only (control group) and first grade students receiving classroom instruction supplemented with multisensory methods taught by the researcher and reinforced by the classroom teacher (treatment group).

An independent samples t-test was conducted to test the null hypothesis. Table 20 shows the mean differences and standard deviations of improvement scores in the treatment and control groups from the pretest to the posttest among the bottom 50th percentile of students, relative to their peers, within each BJA first grade class on the Stanford Achievement Test total reading scores. An analysis of the data reveals that there was not a significant difference between the improvement scores students within the bottom 50th percentile in the treatment group and the control group (p= .173). Thus, the null hypothesis that there is no significant difference in the improvement scores on the DIBELS Oral Reading Fluency subtest is accepted. Results from this analysis are listed in Table 21.

Table 20

Descriptive Statistics for Ho10 (Bottom 50th) Improvement Scores

Group	N	Mean Improvement	Standard Deviation
Control	15	21.53	11.32
Treatment	17	27.82	13.83

Table 21

Ho10 (Bottom 50th) DIBELS Oral Reading Fluency Independent T-Test Results

Equality of Variance (Sig.)	t	df	Mean Difference	Std. Error Difference	p
.711	-1.40	30	-6.29	4.51	.173

Null Hypothesis Eleven

Among the top 50th percentile of students, relative to their peers, within each BJA first grade class on the Stanford Achievement Test total reading scores, there is no significant difference in the improvement scores on the decoding word identification (real word) subtest, as measured by the pretest and posttest, between those first grade students receiving classroom reading instruction only (control group) and first grade students receiving classroom instruction supplemented with multisensory methods taught by the researcher and reinforced by the classroom teacher (treatment group).

An independent samples t-test was conducted to test the null hypothesis. Table 22 shows the mean differences and standard deviations of improvement scores in the treatment and control groups from the pretest to the posttest among the top 50th percentile of students, relative to their peers, within each BJA first grade class on the Stanford Achievement Test total reading scores. An analysis of the data reveals that there was a significant difference between the improvement scores students within the top 50th percentile in the treatment group and the control group (p= .002). Thus, the null hypothesis that there is no significant difference in the improvement scores on the decoding word identification (real word) subtest is rejected. Results from this analysis are listed in Table 23.

Table 22

Descriptive Statistics for Ho11 (Top 50th) Improvement Scores

Group	N	Mean Improvement	Standard Deviation
Control	15	0.53	8.68
Treatment	16	9.63	5.52

Table 23

Ho11 (Top 50th) Decoding Word Identification Independent T-Test Results

Equality of Variance (Sig.)	t	df	Mean Difference	Std. Error Difference	*p*
.205	-3.50	29	-9.10	2.60	.002

Null Hypothesis Twelve

Among the top 50th percentile of students, relative to their peers, within each BJA first grade class on the Stanford Achievement Test total reading scores, there is no significant difference in the improvement scores on the decoding word attack (nonsense word) subtest, as measured by the pretest and posttest, between those first grade students receiving classroom reading instruction only (control group) and first grade students receiving classroom instruction supplemented with multisensory methods taught by the researcher and reinforced by the classroom teacher (treatment group).

An independent samples t-test was conducted to test the null hypothesis. Table 24 shows the mean differences and standard deviations of improvement scores in the treatment and control groups from the pretest to the posttest among the top 50th percentile of students, relative to their peers, within each BJA first grade class on the Stanford Achievement Test total reading scores. An analysis of the data reveals that there was not a significant difference between the improvement scores students within the top 50th percentile in the treatment group and the control group (p= .119). Thus, the null hypothesis that there is no significant difference in the improvement scores on the decoding word attack (nonsense word) subtest is accepted. Results from this analysis are listed in Table 25.

Table 24

Descriptive Statistics for Ho12 (Top 50th) Improvement Scores

Group	N	Mean Improvement	Standard Deviation
Control	15	6.67	11.44
Treatment	16	16.63	21.61

Table 25

Ho12 (Top 50th) Decoding Word Attack Independent T-Test Results

Equality of Variance (Sig.)	t	df	Mean Difference	Std. Error Difference	*p*
.022	-1.62	23.10	-9.96	6.16	.119

Null Hypothesis Thirteen

Among the top 50th percentile of students, relative to their peers, within each BJA first grade class on the Stanford Achievement Test total reading scores, there is no significant difference in the improvement scores of words spelled correctly on the encoding subtest, as measured by the pretest and posttest, between those first grade students receiving classroom reading instruction only (control group) and first grade students receiving classroom instruction supplemented with multisensory methods taught by the researcher and reinforced by the classroom teacher (treatment group).

An independent samples t-test was conducted to test the null hypothesis. Table 26 shows the mean differences and standard deviations of improvement scores in the treatment and control group from the pretest to the posttest among the top 50th percentile of students, relative to their peers, within each BJA first grade class on the Stanford Achievement Test total reading scores. An analysis of the data reveals that there was not a significant difference between the improvement scores students within the top 50th percentile in the treatment group and the control group (p= .092). Thus, the null hypothesis that there is no significant difference in the improvement scores of words spelled correctly on the encoding subtest is accepted. Results from this analysis are listed in Table 27.

Table 26

Descriptive Statistics for Ho13 (Top 50th) Improvement Scores

Group	N	Mean Improvement	Standard Deviation
Control	15	14.60	4.76
Treatment	16	18.56	7.59

Table 27

Ho13 (Top 50th) Encoding (Words Spelled Correctly) Independent T-Test Results

Equality of Variance (Sig.)	t	df	Mean Difference	Std. Error Difference	*p*
.048	1.75	25.44	-3.96	2.26	.092

Null Hypothesis Fourteen

Among the top 50th percentile of students, relative to their peers, within each BJA first grade class on the Stanford Achievement Test total reading scores, there is no significant difference in the improvement scores of phonics points on the encoding subtest, as measured by the pretest and posttest, between those first grade students receiving classroom reading instruction only (control group) and first grade students receiving classroom instruction supplemented with multisensory methods taught by the researcher and reinforced by the classroom teacher (treatment group).

An independent samples t-test was conducted to test the null hypothesis. Table 28 shows the mean differences and standard deviations of improvement scores in the treatment and control group from the pretest to the posttest among the top 50th percentile of students, relative to their peers, within each BJA first grade class on the Stanford Achievement Test total reading scores. An analysis of the data reveals that there was a significant difference between the improvement scores students within the top 50th percentile in the treatment group and the control group (p= .344). Thus, the null hypothesis that there is no significant difference in the improvement scores of phonics points on the encoding subtest is accepted. Results from this analysis are listed in Table 29.

Table 28

Descriptive Statistics for Ho14 (Top 50th) Improvement Scores

Group	N	Mean Improvement	Standard Deviation
Control	15	21.00	8.18
Treatment	16	25.13	14.86

Table 29

Ho14 (Top 50th) Encoding (Phonics Points) Independent T-Test Results

Equality of Variance (Sig.)	t	df	Mean Difference	Std. Error Difference	*p*
.049	-0.97	23.61	-4.13	4.27	.344

Null Hypothesis Fifteen

Among the top 50th percentile of students, relative to their peers, within each BJA first grade class on the Stanford Achievement Test total reading scores, there is no significant difference in the improvement scores on the DIBELS Oral Reading Fluency subtest, as measured by the pretest and posttest, between those first grade students receiving classroom reading instruction only (control group) and first grade students receiving classroom instruction supplemented with multisensory methods taught by the researcher and reinforced by the classroom teacher (treatment group).

An independent samples t-test was conducted to test the null hypothesis. Table 30 shows the mean differences and standard deviations of improvement scores in the treatment and control group from the pretest to the posttest among the top 50th percentile of students, relative to their peers, within each BJA first grade class on the Stanford

Achievement Test total reading scores. An analysis of the data reveals that there was not a significant difference between the improvement scores students within the top 50th percentile in the treatment group and the control group (p= .154). Thus, the null hypothesis that there is no significant difference in the improvement scores on the DIBELS Oral Reading Fluency subtest is accepted. Results from this analysis are listed in Table 31.

Table 30

Descriptive Statistics for Ho15 (Top 50th) Improvement Scores

Group	N	Mean Improvement	Standard Deviation
Control	15	17.73	12.48
Treatment	16	24.19	12.08

Table 31

Ho15 (Top 50th) DIBELS Oral Reading Fluency Independent T-Test Results

Equality of Variance (Sig.)	t	df	Mean Difference	Std. Error Difference	*p*
1.000	-1.46	29	-6.45	4.41	.154

A summary of all null hypotheses and their significance is listed in Table 32.

Table 32

Summary of Statistical Significance for Null Hypotheses

Null Hypotheses	Dependent Variable	Results	*p* value
Ho1	Word Identification	Rejected	.000
Ho2	Word Attack	Rejected	.008
Ho3	Encoding (Wds. Sp. Cor.)	Rejected	.000
Ho4	Encoding (Phonics Pts.)	Rejected	.040
Ho5	Oral Reading Fluency	Accepted	.060
Ho6	Word Identification	Rejected	.001
Ho7	Word Attack	Rejected	.014
Ho8	Encoding (Wds. Sp. Cor.)	Rejected	.000
Ho9	Encoding (Phonics Pts.)	Accepted	.061
Ho10	Oral Reading Fluency	Accepted	.173
Ho11	Word Identification	Rejected	.002
Ho12	Word Attack	Accepted	.119
Ho13	Encoding (Wds. Sp. Cor.)	Accepted	.092
Ho14	Encoding (Phonics Pts.)	Accepted	.344
Ho15	Oral Reading Fluency	Accepted	.154

CHAPTER V

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

This chapter contains the following topics related directly to the summary, conclusion, and recommendations from this study: (a) restatement of the problem; (b) summary of the literature; (c) discussion of the research questions; (d) summary of the methodology; (e) discussion and summary of null hypotheses results; (f) limitations of the study; (g) implications of the study; and (h) recommendations for further research.

Restatement of the Problem

The purpose of this study was to determine whether and to what extent the decoding, encoding and oral reading fluency skills of first grade students using the Bob Jones Press basal reading program were affected depending upon one of two treatments of classroom instruction received: (1) classroom reading program with no supplemental reinforcement, and (2) classroom reading program supplemented with multisensory methods taught by the researcher with additional classroom teacher reinforcement. These students were evaluated using a combination of researcher-created and professionally developed pretests and posttests in order to examine differences in achievement between the two groups in decoding, which was measured by word attack (nonsense words) and word identification (real words) subtests, as well as encoding and oral reading fluency.

Summary of the Literature Review

The review of literature discussed the following elements: critical components of reading acquisition, factors contributing to children's reading difficulties, and the history and study of multisensory language instruction.

Critical Components of Reading Acquisition

According to the National Reading Panel, there are five critical components of reading acquisition: phonemic awareness, phonics, vocabulary, fluency, and comprehension. Each of these components plays a critical role in the process of learning to read. The following summarizes the professional literature as it relates to each of these critical components.

Phonemic awareness (PA) is described as the ability to manipulate the sounds (phonemes) of oral speech. Understanding of the alphabetic principle (through sound-to-letter correspondence) enables the reader to make sense of the sequence of sounds in written form. According to LPA (2004), the stronger the letter/sound association is, the more proficient reading becomes. The NRP conducted a meta-analysis of 52 studies and concluded, based on the results of these studies that "PA training [for reading teachers] benefits not only word reading but also reading comprehension. PA training contributes to children's ability to read and spell for months, if not years, after the training has ended" (p. 2-40).

Phonics is another critical component of reading acquisition because it teaches the skill of decoding printed language through letter-sound correspondence (Allor, 2002; Anthony et al., 2006). According to Popp (2004), "rather than ensuring students master all the rules for decoding words, phonics provides children with an awareness of word structures, and this awareness, in turn, allows them to generalize the rules they have mastered to read new words" (p. 51). The NRP conducted a meta-analysis of 38 studies to determine the effectiveness of phonics instruction through treatment and control group comparisons. Results from this major study revealed that phonics instruction is highly effective in the younger grades with a mean effect size for kindergarten (d = 0.56), and first grade (d = 0.54). Interestingly, reading comprehension also significantly improved with phonics instruction (d = 0.51).

The third critical component of reading acquisition is vocabulary instruction. This involves learning the meaning of words such that a person can understand those words in context, and is a critical component because without an understanding of words, the reader has no way to make sense of what he is reading. The NRP conducted a meta-analysis of 50 studies to determine the best methods for teaching vocabulary, and concluded that both direct and indirect instruction positively contribute to reading comprehension. Direct instruction involves introducing new words before reading through a text, working with these words in different contexts over an extended period of time (White, Graves, & Slater, 1990), and teaching word-learning strategies (Lehr & Osborn, 2005). Indirect instruction involves the learning of vocabulary words through conversation with adults, by being read to (Dickinson & Smith, 1994), and by seeing new words through reading by one's self (Herman et al., 1987).

The fourth component of reading acquisition is reading fluency. According to NIL (2002), fluency is the ability to read texts quickly and accurately by reading phrase by phrase rather than word by word (Hooks & Jones, 2002). There are three primary elements that make up fluency: reading rate, reading accuracy, and reading expression (NRP, 2000; Kuhn & Stahl, 2004). Studies have shown that reading fluency positively affects comprehension (Nation & Snowling, 1997; Wise et al., 2010). Given that reading fluency is so important for comprehension, many of the studies conducted on this critical component have focused on how to improve this skill. The two most notable methods for doing so include guided oral reading and repeated readings. The NRP conducted a meta-analysis on one of these two methods—guided oral reading—to determine to what extent it improves reading fluency. The results revealed a moderate effect size (d = 0.41) on reading achievement. The NRP concluded that guided oral reading practices that include feedback, direct instruction, and positive suggestions regarding rate, expression, and accuracy "helped students across a wide range of grade levels to learn to recognize new words, helped them to read accurately and easily, and helped them to comprehend what they read" (p. 1).

The fifth, and most important, element of reading acquisition is comprehension. According to LPA (2004) comprehension is the connection between the reader's own background knowledge (or schema) to what is being read. Without comprehension, words are just senseless symbols on a page; thus, comprehension is a critical component, and the ultimate goal of reading, because it enables the reader to make sense of these symbols (Brummit-Yale, 2012) and understand their meaning in context with each other. The NRP conducted a meta-analysis of 204 studies to determine the best methods for teaching reading comprehension. These methods are: comprehension monitoring, cooperative learning, graphic and semantic organizers, questions and answers, question generation, story structure, and story summarization. Although the "question generation" method seems to be the most effective individual method of improving comprehension, including all these strategies is considered the most effective means of doing so (NRP, 2000).

Children's Factors Contributing to Reading Difficulties

Two primary factors affect a child's reading abilities: his biological make-up and his environment. These categories are not always independent from one another, however. Environmental factors can play a significant role in the development of a child's brain, which in turn influences his ability to read. On the other hand, a child's biological make-up and physical limitations will naturally influence the environment in which he learns to read.

In order to better understand the biological factors underlying reading disabilities, many researchers have conducted studies comparing brain images of those with reading disabilities to those without such disabilities. These studies focus primarily on the differences in brain composition and brain function between these two groups. Studies that look at brain composition typically analyze the symmetry of the brain's left and right hemispheres (Heim & Keil, 2004), as well as the volume of gray and white mater within specific regions of the brain (Booth & Burman, 2001; Klingberg et al., 2000), while studies on brain function investigate the location and amount of brain activity during cognitive tasks (Shaywitz e al., 2002; Stoodley & Stein, 2013).

Booth and Burman (2001) noted that persons with a reading disability have less gray matter in the area of the brain that aids in word identification. Since gray matter is used for processing information, a lesser amount of it naturally correlates to difficulty with word identification processing, and thus, reduced phonological awareness skills. Researchers have also noted differences between the two groups in the amount of white matter within the area of the brain that correlates written words to spoken words. Klingberg et al., 2000 determined that an increase in white matter has been associated with increased reading skills, and that those with reading disabilities have less white matter in this area of the brain than those who do not struggle with reading. This smaller amount of white matter decreases how quickly information is communicated throughout the brain, thus impacting, and likely reducing, a reader's processing speed (Booth & Burman, 2001).

Additional research reveals that the brains of persons struggling with certain aspects of reading often have an enlarged right hemisphere. Given that the left hemisphere is the area of the brain primarily involved in reading (Leonard et al., 2001; Stoodley & Stein, 2013; Shaywitz & Shaywitz, 2007), the fact that the right side of the brain is enlarged suggests that this hemisphere is used more often during reading, which makes the entire reading process much less efficient.

The question has been raised over whether these differences in brain composition are a cause of reading difficulties or rather the result of reading difficulties. Brain research on pre-readers at risk for reading disabilities show that the structural abnormalities are already in place prior to reading acquisition (Raschle, 2011). While research has not exhausted this area of study, it does suggest the strong possibility that these differences are the cause rather than the result of reading difficulties.

In addition to a different brain composition, persons with reading difficulties also evidence differences in how their brains function in comparison to persons without reading difficulties. In one of the largest studies ever conducted on this subject, Shaywitz and Shaywitz (2002) examined 144 children by taking brain images of them as they were performing reading-related tasks. Approximately half of these children had previously been diagnosed with a reading disability. The results of the study revealed that the fluent readers tended to have a higher amount of activity in the areas of the brain involved in critical reading skills, while those who struggled showed more activity in areas of the brain that are not as directly involved in the efficient processing of reading skills.

These studies provide convincing evidence that both brain composition and brain function differ in persons with reading difficulties when compared to those who do not struggle with reading. These biological brain characteristics however, are not the only factors that influence reading abilities. Environmental factors play just as much, if not more, of a significant role in the process of learning to read.

A child's environment consists primarily of his home life and his school life. Probably the largest variable that influences the child's learning environment at home is the socioeconomic (SES) status of the household. The reason this plays such a large role is because it is so heavily linked to other factors that influence learning. The following variables are often found in low SES families and have the potential to negatively influence a child's reading skills, although they certainly do not in every case: single parent households (Entwisle & Alexander, 1996); an increased number of siblings (Downey, 2001); and no college or advanced degree on the part of the mother (Gratz, 2006). Another primary factor that influences the child's home learning environment, particularly as it relates to reading, is the extent to which English is spoken in the home. Children who have English as a second language are often referred to as English Language Learners (ELL). In many cases, these children enter school at a disadvantage over their English-speaking counterparts, given that they are still trying to learn and speak English due to their limited exposure to and practice of the language in the home.

A young child's school environment also plays a significant role in his learning abilities, and particularly on his ability to read. One of the primary factors that affect the school environment, and thus, the learning environment, is the leadership's commitment to academic excellence (Leithwood et al., 2004; Wilson 2011). Having a strong and capable administrator who is willing and able to take the necessary steps to enhance and strengthen the school's learning environment will go a long way towards creating an atmosphere where achievement in excellence is the standard. Other factors that play significant roles in student academic achievement, and thus in reading achievement, are the teachers' expectations for their students (Muller, Katz, & Dance, 1999), the overall school climate as it relates to orderliness and safety (Lee & Bryk, 1989), and the frequency of student evaluations (Wilson, 2011). The more frequently students are evaluated, the sooner gaps in learning are discovered and able to be remedied. When a teacher expects a child to do well, and the school has provided the necessary structure, assessments and tools to give that child the best chance possible, he is far more likely to succeed than if he were in a school in which the commitment to learning is an afterthought.

Explanation of Multisensory Language Instruction

More than ever before, classroom teachers are faced with an increasing array of reading readiness skills, intellectual abilities and learning styles among the students in their classrooms. As a result, it is becoming necessary to provide differentiated instruction to meet the diverse needs of these learners. Many studies have looked at the effectiveness of using various multisensory methods as an answer to meet these needs.

A multisensory approach to language, and particularly, reading, instruction teaches individual phonics skills and other language skills to the point of mastery in a systematic and cumulative manner. Students must gain mastery over prerequisite skills in order to progress forward to more complex skills. The language skills are taught bi-directionally, which means they are practiced in both decoding (sound-to-letter correspondence) and encoding (letter to sound correspondence) exercises. Reading fluency and comprehension skills are increasingly integrated as the student demonstrates an understanding of letter-sound relationships (IMSLEC, 2013; Wilson, 1989; IDA, 2009).

According to the International Multisensory Structured language Education Council [IMSLEC] (2013) multisensory instruction includes particular content and principles. The content of multisensory instruction includes phonology, sound-symbol association, syllable instruction, morphology, syntax, and semantics. The principles of multisensory instruction include the simultaneous use of multiple senses that are taught systematically and cumulatively, direct instruction that is taught diagnostically, and synthetic and analytic instruction.

The goal of using multisensory methods is to create and fortify links between the neurological pathways in the brain that may not have a solid connection (IDA, 2009). Studies suggest that this is best done by using multisensory methods integrated with a phonics-based approach to reading. A dissertation study by Stewart (2011) supports the idea that direct phonics taught to first graders using multisensory methods (as occurred in the study treatment group) is superior to using an embedded phonics approach without a kinesthetic-tactile component (the control group). The study showed that the treatment group showed statistically significant improvement over the control group in their oral reading fluency skills following the intervention.

A study by Wilson and O'Connor (1995) examined the impact of multisensory instruction involving a kinesthetic-tactile component tied in with encoding and decoding to determine its effects on student progress in reading and spelling. Most of the students participating in the study had been in special education and approximately 35% had been retained at least one grade. Results from this study revealed significant student gains in word attack and passage comprehension. The findings revealed a positive correlation between multisensory instruction and student spelling and reading achievement.

Multisensory language instruction has most often been reserved for use with students that are considered struggling readers. If multisensory methods help this group of children, this then raises the question as to whether low-average, average, or even above-average readers can be positively impacted by this method with its use in the regular classroom. Scheffel, Shaw, and Shaw (2008) conducted a large study to determine the impact of multisensory reading instruction on “some risk” readers (low readers) and “low risk” readers (average readers). Both the control group and the treatment group contained a mix of both low and average readers. The control group was taught using strictly the classroom reading curriculum while the treatment group received the same classroom instruction supplemented with the Orton-Gillingham program. The study showed more students in the treatment group than in the control group transitioned out of the some-risk category into the low-risk category following the intervention. Although the greatest benefit was to the lowest readers within the treatment group, the study indicated that this method can be helpful to average readers as well. Trepanier (2009) and Negin (2009) also conducted studies to determine if multisensory methods were effective in the reading classroom at large, as opposed to limited to just for use with struggling readers. These two studies compared the effect on various reading skills that multisensory methods used in conjunction with a classroom basal reading program (treatment group) would have, versus the effect on those same skills when using the basal reading curriculum without the multisensory component. Both studies showed that the treatment groups showed greater levels of reading gains over their counterparts in the control group, thus once again evidencing that multisensory methods can be beneficial to all readers—not just those who are struggling.

Summary of Methodology

The purpose of this study was to determine the effects of multisensory instruction correlated with the Bob Jones Press reading program on students’ decoding, encoding, and oral reading fluency skills. The sample population included 63 first grade students at BJA, with 33 students in the treatment group and 30 in the control group. The treatment group received supplemental multisensory instruction that correlated with the BJA basal reading program and was delivered by the researcher three times a week for 15 minutes over a period of 12 weeks. Additionally, the classroom teachers of the treatment group reinforced these multisensory methods throughout the week using an implementation checklist provided by the researcher. Multisensory instruction included encoding and decoding activities directly related to the phonics skills used in the basal readers. The control group only received the basal reading instruction with no additional multisensory methods provided by the researcher or classroom teachers. All 63 students were given pretests prior to the start of the study and posttests at the conclusion of the study. These tests were alternate forms of each other and consisted of decoding word identification (real words), decoding word attack (nonsense words), encoding (spelling and phonics points), and oral reading fluency. The researcher created the decoding word identification, decoding word attack, and encoding subtests and use the commercially-available DIBELS test to evaluate oral reading fluency. The decoding word identification, decoding word attack, and oral reading fluency tests were individually administered by two separate evaluators. The encoding tests were group- administered by each classroom teacher following a scripted format.

Data was analyzed using the SPSS software to analyze and test the null hypotheses. The statistical analysis used was an independent t-test on all null hypotheses, the significance level of which were set at the p= .05 level of significance.

Discussion of the Research Questions

1. Does supplemental multisensory instruction improve overall student performance in decoding, encoding and oral reading fluency of first grade students as measured by a pretest and posttest?

   The statistical analyses for null hypotheses one through five revealed that supplemental multisensory instruction does positively impact overall student performance in decoding, encoding, and oral reading fluency. Results were statistically significant for both word identification and word attack subtests of decoding proficiency. Results were also significant for encoding proficiency including students' ability to spell words correctly and apply appropriate phonics rules for the spelling of words. Results approached significance in improved oral reading fluency skills. Therefore, it can be concluded that multisensory instruction does positively impact overall student performance in these specific reading skills.

2. Does supplemental multisensory instruction improve performance in decoding, encoding and oral reading fluency of first grade students in the bottom 50th percentile of total reading scores on the Stanford Achievement Test within the BJA first grade as measured by a pretest and posttest?

   The statistical analyses for null hypotheses six through ten revealed that supplemental multisensory instruction does impact student performance of those within the bottom 50th percentile, in decoding, encoding, and oral reading fluency. Results were statistically significant for both word identification and word attack subtests of decoding proficiency. Results were significant for the “words spelled correctly” skill of the encoding subtest. The students’ abilities to apply appropriate phonics rules to the spelling of words approached significant at .061, suggesting the supplemental multisensory instruction made a positive contribution to students encoding abilities.

Although results were not significant in the students’ oral reading fluency skills, the scores favored the treatment group. Therefore, it can be concluded that multisensory instruction does positively impact overall student performance in these specific reading skills.

3. Does supplemental multisensory instruction improve performance in decoding, encoding and oral reading fluency of first grade students in the top 50th percentile of total reading scores on the Stanford Achievement Test within the BJA first grade as measured by a pretest and posttest?

The statistical analyses for null hypotheses eleven through fifteen revealed that supplemental multisensory instruction does have a moderate impact on student performance, within the top 50th percentile, in decoding, encoding, and oral reading fluency abilities. Results were statistically significant for the decoding word identification subtest. Although the decoding word attack subtest results were not significant, the treatment group performed better than the control group by an average increase of ten words. Students within the treatment group also performed better than the control group students on both parts of the encoding subtest—words spelled correctly and phonics points—suggesting, the supplemental multisensory instruction made a positive contribution to students encoding abilities. Although results were not significant in the students' oral reading fluency skills, the scores favored the treatment group by an average increase of seven words per minute. Therefore, it can be concluded that multisensory instruction does positively impact overall student performance in these specific reading skills.

Discussion of Null Hypotheses Results

Null Hypotheses One, Six, and Eleven (Word Identification)

There is no significant difference in the improvement scores on the decoding word identification (real word) subtest, as measured by the pretest and posttest, between:

(Ho1) all first grade students

(Ho6) students among the bottom 50th percentile, relative to their peers within the BJA first grade class on the Stanford Achievement Test total reading scores

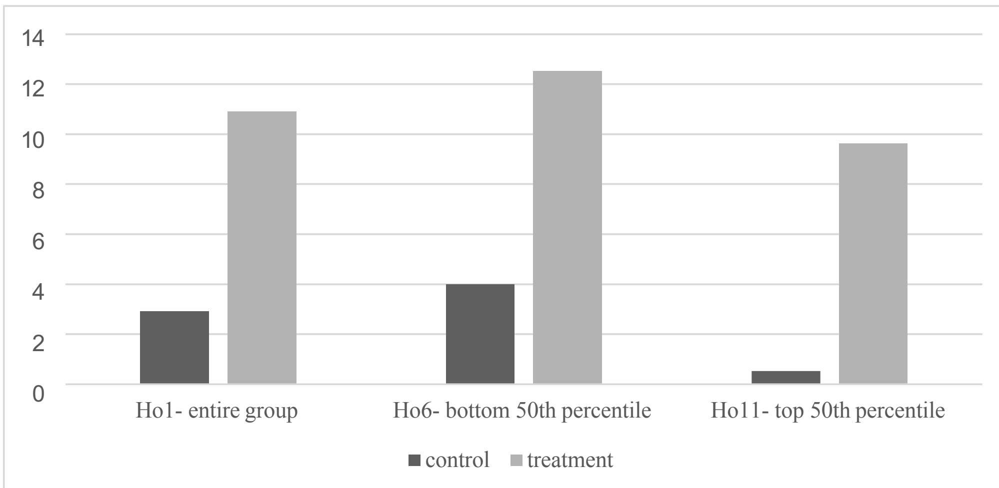
(Ho11) students among the top 50th percentile, relative to their peers within the BJA first grade class on the Stanford Achievement Test total reading scores receiving classroom reading instruction only (control group) and first grade students receiving classroom instruction supplemented with multisensory methods taught by the researcher and reinforced by the classroom teacher (treatment group).

An analysis of the results revealed a significant difference in favor of the treatment group in all three subgroups included in the three decoding word identification null hypotheses. In null hypothesis one (entire population), the control group improved 2.93 words per minute and the treatment group improved 10.91 words per minute. The mean difference between these two groups, in null hypothesis one, was 7.98 words per minute with a statistical significance of p= .000. In null hypothesis six (bottom 50th percentile), the control group improved 4.00 words per minute and the treatment group improved 12.53 words per minute. The mean difference between the bottom 50th percentile of students within the treatment and control group was 8.53 words per minute with a statistical significance of p= .001. In null hypothesis eleven (top 50th percentile), the control group improved .53 words per minute and the treatment group improved 9.63 words per minute. The mean difference between the top 50th percentile of students within the treatment and control group was 9.10 words per minute in favor of the treatment group with a statistical significance of p= .002.

Figure 1 illustrates the three different groups and their mean improvement scores results from the treatment provided during the study. Given the difference in sample size between the entire group and its subgroups (bottom and top 50th percentiles) it is difficult to accurately compare the entire group to these subgroups. However, it is clear that there was a significant increase in the treatment group across all three comparisons.

Figure 1

Decoding Word Identification Mean Improvement Scores by Group



The purpose of this test was to determine the students' ability to quickly apply knowledge of phonics rules to the decoding of isolated real words. According to a research study conducted by Morris et al (2010) a timed reading of isolated words was statistically significant in providing a reliable indicator of children's reading abilities. Significance among all three groups was considerable. These results suggest that the integration of multisensory reading techniques improves a child's ability to quickly decode words, therefore providing more mental capacity for the skill of comprehending the text.

Null Hypotheses Two, Seven, and Twelve (Word Attack)

There is no significant difference in the improvement scores on the decoding word attack (nonsense word) subtest, as measured by the pretest and posttest, between:

(Ho2) all first grade students

(Ho7) students among the bottom 50th percentile, relative to their peers within the BJA first grade class on the Stanford Achievement Test total reading scores

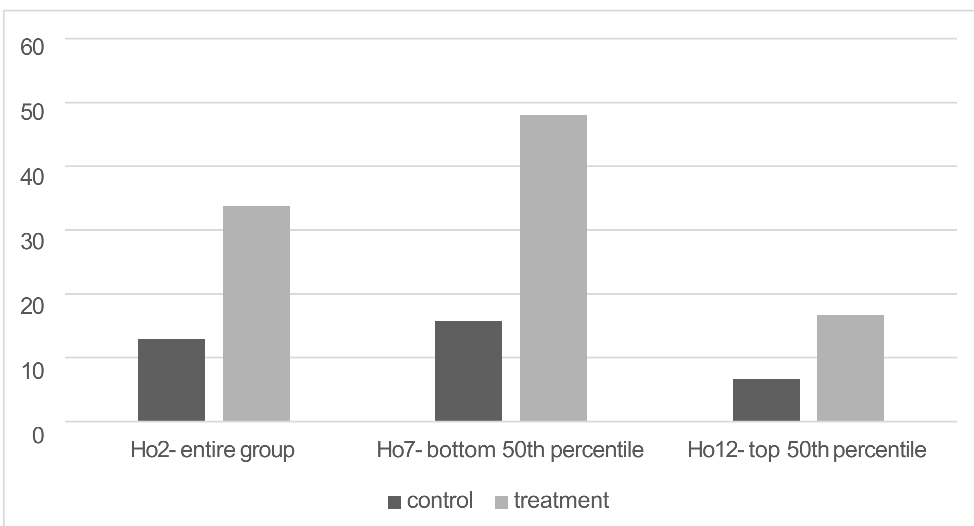
(Ho12) students among the top 50th percentile, relative to their peers within the BJA first grade class on the Stanford Achievement Test total reading scores receiving classroom reading instruction only (control group) and first grade students receiving classroom instruction supplemented with multisensory methods taught by the researcher and reinforced by the classroom teacher (treatment group).

An analysis of the results revealed a significant difference in favor of the treatment group in the entire population and its subsection of the bottom 50th percentile. There was no significant difference found in the subsection of the top 50th percentile, however the improvement scores were still greater in the treatment group. In null hypothesis two (entire population), the two groups decoded nonsense words until a ceiling of five consecutive words were pronounced incorrectly. The control group improved by 12.90 words and the treatment group improved by 33.70 words. The mean difference between these two groups, in null hypothesis one, was 20.80 words with a statistical significance of $p = .008$. In null hypothesis six (bottom 50th percentile), the control group improved by 15.80 words and the treatment group improved by 47.94 words. The mean difference between the bottom 50th percentile of students within the treatment and control group was 32.14 words with a statistical significance of $p = .014$. In null hypothesis twelve (top 50th percentile), the control group improved by 6.67 words and the treatment group improved by 9.63 words. The mean difference between the top 50th percentile of students within the treatment and control group was 9.96 words per minute with a significance of *p*= .119.

Figure 2 illustrates the three different groups and their mean improvement scores results from the treatment provided during the study. Comparisons between the top and bottom 50th percentile favor the bottom 50th percentile in positive treatment effects. The mean difference between the top and bottom 50th percentile is 22.18 words, indicating the substantial increase that students in the bottom 50th percentile made in their ability to apply phonics rules to unknown words in comparison to students in the top 50th percentile.

Figure 2

Word Attack Mean Improvement Scores by Group



According to Schrank, Wendling and Woodcock (2008) the ability to translate this knowledge of phonics rules to the reading of nonsense words "indicates the presence of a unique process for recognizing printed forms-that is, assembling the pronunciation of a letter string by applying knowledge of typical correspondences between grapheme units and sounds" (p. 26). Based on these results, it can be concluded that the multisensory language instruction positively affected students' ability to decode words never seen before through their knowledge of the phonics rules that were taught.

Null Hypotheses Three, Eight, and Thirteen (Encoding, Words Spelled Correctly)

There is no significant difference in the improvement scores of words spelled correctly on the encoding subtest, as measured by the pretest and posttest, between:

(Ho3) all first grade students

(Ho8) students among the bottom 50th percentile, relative to their peers within the BJA first grade class on the Stanford Achievement Test total reading scores

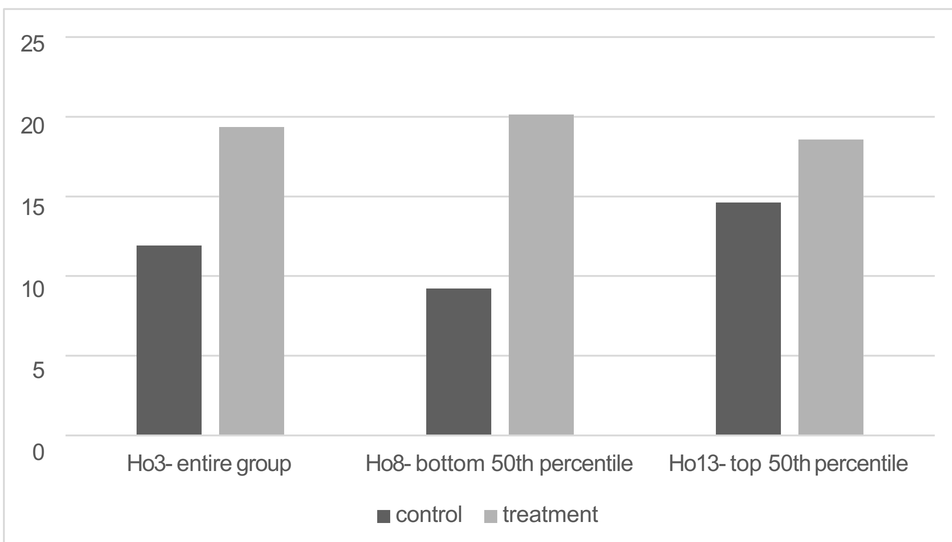
(Ho13) students among the top 50th percentile, relative to their peers within the BJA first grade class on the Stanford Achievement Test total reading scores receiving classroom reading instruction only (control group) and first grade students receiving classroom instruction supplemented with multisensory methods taught by the researcher and reinforced by the classroom teacher (treatment group).

An analysis of the results revealed a significant difference in favor of the treatment group in the entire population and its subsection of the bottom 50th percentile. There was no significant difference found in the subsection of the top 50th percentile, however the improvement scores approached significance in favor of the treatment group. In null hypothesis three, students were scored according to how many words they spelled correctly. Because the treatment included encoding (spelling) instruction as a means of reinforcing and solidifying the phonics concepts, students were evaluated on their ability to correctly spell words which contained all of the phonics rules that were taught during the study. These results revealed that the control group improved their encoding abilities by 11.90 words and the treatment group improved their encoding abilities by 19.36 words. The mean difference between these two groups, in null hypotheses one, was 7.47 words with a statistical significance of $p = .000$. In null hypothesis eight (bottom 50th percentile), the control group improved their encoding abilities by 9.20 words and the treatment group improved their encoding abilities by 20.12 words. The mean difference between the bottom 50th percentile of students within the treatment and control group was 10.92 words with a statistical significance of $p = .000$. In null hypothesis thirteen (top 50th percentile), the control group improved in their encoding abilities by 14.60 words and the treatment group improved in their encoding abilities by 18.56 words. The mean difference between the top 50th percentile of students within the treatment and control group was 3.96 words which approached statistical significance at $p = .092$.

Figure 3 illustrates the three different groups and their mean improvement score results from the treatment provided during the study. Comparisons between the top and bottom 50th percentile continued to favor the bottom 50th percentile in positive treatment effects. The mean difference between the top and bottom 50th percentile was 6.96 words, thereby showing a reduction in the gap of mean differences between students' understanding of phonics rules in spelling words, as indicated in the null hypotheses evaluation of phonics points, versus the ability to use the right phonics rules to spell a word correctly, as indicated in the null hypotheses evaluation of words spelled correctly. The researcher hypothesized that the reduction in mean differences between the words spelled correctly and the phonics points null hypotheses, of the top and bottom 50th percentile students, could be due to the fact that many spelling rules were taught during the study that may have aided the treatment group in better recognizing which groups of letters should be chosen in order to spell the word.

Figure 3

Encoding (Words Spelled Correctly) Mean Improvement Scores by Group



According to Popp (2004), a productive way to practice phonics skills is through spelling practice because it helps the student recognize the connection between spoken words and their individual phonemes and the graphemes that represent them. These results reveal that the encoding part of the treatment had a positive impact not only in students' spelling abilities but also contributed to their overall reading abilities. These findings are similar to those conducted by Blachman et al. (2004), who sought to determine effects of encoding and decoding instruction using multisensory techniques on students' reading and spelling abilities. They found a moderate-to-strong correlation between the intervention and student improvement in real and nonsense word reading, reading rate, passage reading, and spelling. Based on the results of the current study, it can be concluded that encoding instruction does help students' overall reading and spelling and should be considered an important part of any phonics and reading program.

Null Hypotheses Four, Nine, and Fourteen (Encoding, Phonics Points)

There is no significant difference in the improvement scores of phonics points on the encoding subtest, as measured by the pretest and posttest, between:

(Ho4) all first grade students

(Ho9) students among the bottom 50th percentile, relative to their peers within the BJA first grade class on the Stanford Achievement Test total reading scores

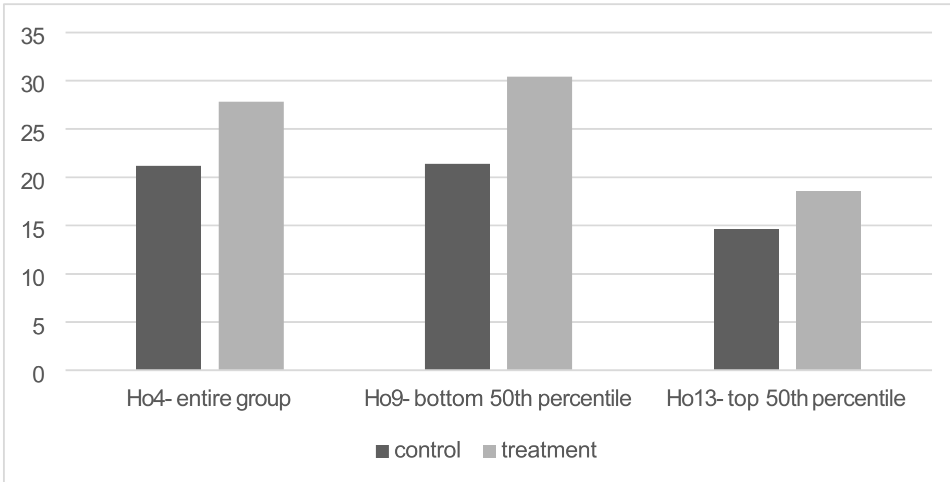
(Ho14) students among the top 50th percentile, relative to their peers within the BJA first grade class on the Stanford Achievement Test total reading scores receiving classroom reading instruction only (control group) and first grade students receiving classroom instruction supplemented with multisensory methods taught by the researcher and reinforced by the classroom teacher (treatment group).

An analysis of the results revealed a significant difference in favor of the treatment group in the entire population and approached significance in its subsection, the bottom 50th percentile. There was no significant difference found in the subsection of the top 50th percentile, however the improvement scores were greater for the treatment group than the control group. In null hypothesis four (entire population), students were scored according to the amount of appropriate phonics rules they used to spell a word. Therefore students could be awarded phonics points for a word if they chose a correct phonics rule to spell the word even if they did not spell the word correctly. For example, a student could have received 2/2 phonics points for the word "tie," if he spelled it "tigh." The word was not spelled correctly, but the student understood that the "igh" can also make the long /i/ sound at the end of a word.

The results of this evaluation, as indicated in figure 4, revealed that the control group improved their encoding abilities by 21.20 phonics points and the treatment group improved their encoding abilities by 27.85 words. The mean difference between these two groups, in null hypothesis four, was 6.65 phonics points with a statistical significance of $p = .040$. In null hypothesis nine (bottom 50th percentile), the control group improved their encoding abilities by 21.40 phonics points and the treatment group improved their encoding abilities by 30.41 phonics points. The mean difference between the bottom 50th percentile of students within the treatment and control group was 9.01 phonics points approaching statistical significance at $p = .061$. In null hypothesis fourteen (top 50th percentile), the control group improved in their encoding abilities by 21.00 phonics points and the treatment group improved in their encoding abilities by 25.13 phonics points. The mean difference between the top 50th percentile of students within the treatment and control group was 4.13 phonics points with a statistical significance of $p = .344$.

Figure 4

Encoding (Phonics Points) Mean Improvement Scores by Group



Because the Bob Jones Press curriculum includes a separate phonics component that is taught separately from the reading curriculum, both of which were provided for the treatment and control groups, it is evident that the students within all three comparisons are applying appropriate phonics rules to the spelling of words, even if the words are spelled incorrectly. Figure 4 illustrates this fact with the mean differences of 6.65 for null hypothesis four (entire group), 9.01 for null hypothesis nine (bottom 50^{th} percentile), and 4.13 for null hypothesis thirteen (top 50^{th} percentile). Despite the smaller mean differences, a comparison between the bottom and top 50^{th} percentiles revealed that students in the bottom 50^{th} percentile benefitted the most from the multisensory language instruction.

Null Hypotheses Five, Ten, and Fifteen (Oral Reading Fluency)

There is no significant difference in the improvement scores on the DIBELS Oral Reading Fluency subtest, as measured by the pretest and posttest, between:

(Ho5) all first grade students

(Ho10) students among the bottom 50th percentile, relative to their peers within the BJA first grade class on the Stanford Achievement Test total reading scores

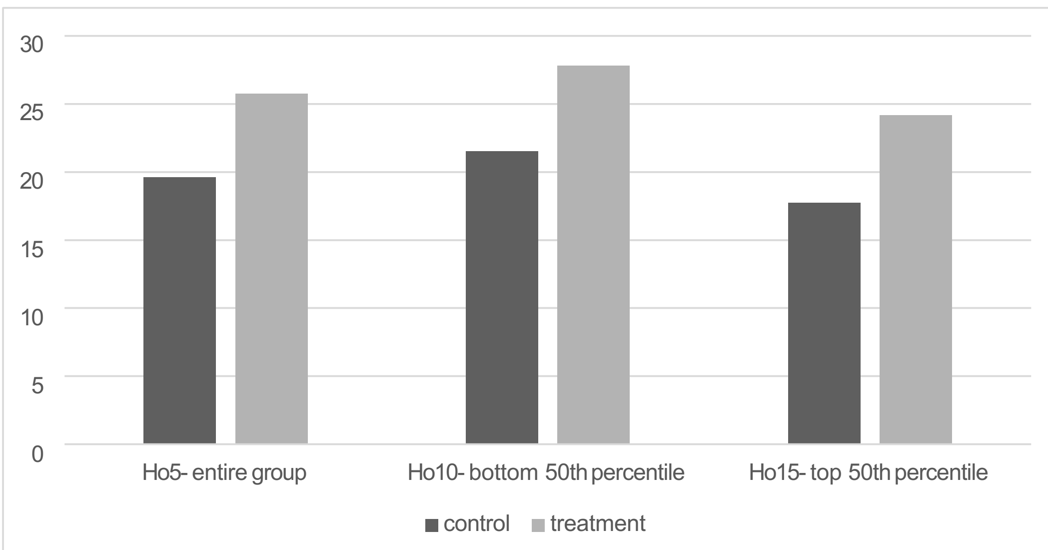
(Ho15) students among the top 50th percentile, relative to their peers within the BJA first grade class on the Stanford Achievement Test total reading scores

receiving classroom reading instruction only (control group) and first grade students receiving classroom instruction supplemented with multisensory methods taught by the researcher and reinforced by the classroom teacher (treatment group).

An analysis of the results revealed no significant differences in any of the treatment groups for the three null hypotheses, however the improvement scores favored all three treatment groups. In null hypothesis five, students were evaluated in their ability to read connected text within a one-minute timed sample. Three samples were taken and the average of these samples was recorded for each student. The control group improved 19.63 words per minute and the treatment group improved 25.76 words per minute. The mean difference between these two groups was 6.12 words per minute which approached statistical significance ($p = .060$). In null hypothesis ten (bottom 50th percentile), the control group improved 21.53 words per minute and the treatment group improved 27.82 words per minute. The mean difference between the bottom 50th percentile of students within the treatment and control group was 6.29 words per minute with a statistical significance of *p*= .123. In null hypothesis fifteen (top 50th percentile), the control group improved 17.73 words per minute and the treatment group improved 24.19 words per minute. The mean difference between the top 50th percentile of students within the treatment and control group was 6.45 words per minute with a significance of *p*= .154. In figure 5, the mean score between the three comparisons are very similar, indicating that the treatment affects were the same.

Figure 5

Oral Reading Fluency Mean Improvement Scores by Group



These results are consistent with the findings of Bitter and White (2011), who studied the effects of multisensory language instruction on over 1,000 students over a four year period from kindergarten to third grade. Treatment group students statistically outperformed control group students on oral reading fluency each year in first, second, and third grade indicating the positive impact that multisensory instruction has on these skills.

Table 33

Summary of Analysis of Null Hypotheses

Number	Statement	Result	*P*
Ho1	Among all first grade students, there is no significant difference in the improvement scores on the decoding word identification (real word) subtest, as measured by the pretest and posttest, between those students receiving classroom reading instruction only (control group) and those receiving classroom instruction supplemented with multisensory methods taught by the researcher and reinforced by the classroom teacher (treatment group).	Rejected	.000
Ho2	Among all first grade students, there is no significant difference in the improvement scores on the improvement scores on the decoding word attack (nonsense word) subtest, as measured by the pretest and posttest, between those students receiving classroom reading instruction only (control group) and those receiving classroom instruction supplemented with multisensory methods taught by the researcher and reinforced by the classroom teacher (treatment group).	Rejected	.008

(continued)

Number	Statement	Result	*P*
Ho3	Among all first grade students, there is no significant difference in the improvement scores of words spelled correctly on the encoding subtest, as measured by the pretest and posttest, between all first grade students receiving classroom reading instruction only (control group) and first grade students receiving classroom instruction supplemented with multisensory methods taught by the researcher and reinforced by the classroom teacher (treatment group).	Rejected	.000
Ho4	Among all first grade students, there is no significant difference in the improvement scores of phonics points on the encoding subtest, as measured by the pretest and posttest, between those students receiving classroom reading instruction only (control group) and first grade students receiving classroom instruction supplemented with multisensory methods taught by the researcher and reinforced by the classroom teacher (treatment group).	Rejected	.040

(continued)

Number	Statement	Result	*P*
Ho5	Among all first grade students, there is no significant difference in the improvement scores on the DIBELS Oral Reading Fluency subtest, as measured by the pretest and posttest, between those students receiving classroom reading instruction only (control group) and those receiving classroom instruction supplemented multisensory methods taught by the researcher and reinforced by the classroom teacher (treatment group).	Accepted	.060
Ho6	Among the bottom 50th percentile of students, relative to their peers, within each BJA first grade class on the Stanford Achievement Test total reading scores, there is no significant difference in the improvement scores on the decoding word identification (real word) subtest, as measured by the pretest and posttest, between those first grade students receiving classroom reading instruction only (control group) and first grade students receiving classroom instruction supplemented with multisensory methods taught by the researcher and reinforced by the classroom teacher (treatment group).	Rejected	.001

(continued)

Number	Statement	Result	*P*
Ho7	Among the bottom 50th percentile of students, relative to their peers, within each BJA first grade class on the Stanford Achievement Test total reading scores, there is no significant difference in the improvement scores on the decoding word attack (nonsense word) subtest, as measured by the pretest and posttest, between those first grade students receiving classroom reading instruction only (control group) and first grade students receiving classroom instruction supplemented with multisensory methods by the researcher and reinforced by the classroom teacher (treatment group).	Rejected	.014
Ho8	Among the bottom 50th percentile of students, relative to their peers, within each BJA first grade class on the Stanford Achievement Test total reading scores, there is no significant difference in the improvement scores of words spelled correctly on the encoding subtest, as measured by the pretest and posttest, between those first grade students receiving classroom reading instruction only (control group) and first grade students receiving classroom instruction supplemented multisensory methods taught by the researcher and reinforced by the classroom teacher (treatment group).	Rejected	.000

(continued)

Number	Statement	Result	*P*
Ho9	Among the bottom 50th percentile of students, relative to their peers, within each BJA first grade class on the Stanford Achievement Test total reading scores, there is no significant difference in the improvement scores of phonics points on the encoding subtest, as measured by the pretest and posttest, between those first grade students receiving classroom reading instruction only (control group) and first grade students receiving classroom instruction supplemented with multisensory methods taught by the researcher and reinforced by the classroom teacher (treatment group).	Accepted	.061
Ho10	Among the bottom 50th percentile of students, relative to their peers, within each BJA first grade class on the Stanford Achievement Test total reading scores, there is no significant difference in the improvement scores on the DIBELS Oral Reading Fluency subtest, as measured by the pretest and posttest, between those first grade students receiving classroom reading instruction only (control group) and first grade students receiving classroom instruction supplemented with multisensory methods taught by the researcher and reinforced by the classroom teacher (treatment group).	Accepted	.173

(continued)

Number	Statement	Result	*P*
Ho11	Among the top 50th percentile of students, relative to their peers, within each BJA first grade class on the Stanford Achievement Test total reading scores, there is no significant difference in the improvement scores on the decoding word identification (real word) subtest, as measured by the pretest and posttest, between those first grade students receiving classroom reading instruction only (control group) and first grade students receiving classroom instruction supplemented with multisensory methods taught by the researcher and reinforced by the classroom teacher (treatment group).	Rejected	.002
Ho12	Among the top 50th percentile of students, relative to their peers, within each BJA first grade class on the Stanford Achievement Test total reading scores, there is no significant difference in the improvement scores on the decoding word attack (nonsense word) subtest, as measured by the pretest and posttest, between those first grade students receiving classroom reading instruction only (control group) and first grade students receiving classroom instruction supplemented with multisensory methods t taught by the researcher and reinforced by the classroom teacher (treatment group).	Accepted	.119

(continued)

Number	Statement	Result	*P*
Ho13	Among the top 50th percentile of students, relative to their peers, within each BJA first grade class on the Stanford Achievement Test total reading scores, there is no significant difference in the improvement scores of words spelled correctly on the encoding subtest, as measured by the pretest and posttest, between those first grade students receiving classroom reading instruction only (control group) and first grade students receiving classroom instruction supplemented multisensory methods taught by the researcher and reinforced by the classroom teacher (treatment group).	Accepted	.092
Ho14	Among the top 50th percentile of students, relative to their peers, within each BJA first grade class on the Stanford Achievement Test total reading scores, there is no significant difference in the improvement scores of phonics points on the encoding subtest, as measured by the pretest and posttest, between those first grade students receiving classroom reading instruction only (control group) and first grade students receiving classroom instruction supplemented with multisensory methods taught by the researcher and reinforced by the classroom teacher (treatment group).	Accepted	.344

(continued)

Number	Statement	Result	*P*
Ho15	Among the top 50th percentile of students, relative to their peers, within each BJA first grade class on the Stanford Achievement Test total reading scores, there is no significant difference in the improvement scores on the DIBELS Oral Reading Fluency subtest, as measured by the pretest and posttest, between those first grade students receiving classroom reading instruction only (control group) and first grade students receiving classroom instruction supplemented with multisensory methods taught by the researcher and reinforced by the classroom teacher (treatment group).	Accepted	.154

Limitations of the Study

There were several limitations of this study that, if they can be eliminated in future studies on this subject, would cause the results to more closely align with the actual impact of the intervention. These limitations were the delayed start of the study, the use of researcher-created assessments, the limited classroom time available for the supplemental multisensory instruction by the researcher, the small sample size that resulted in the groups that were divided between the top and bottom below 50th percentiles, and the use of intact classes.

The original intention with this dissertation study was that the researcher, from the beginning of the school year, would supplement with multisensory methods each phonics skill as it was being taught to both treatment and control groups by their classroom teachers. Because the study was delayed a month, the students had learned quite a few phonics skills without the multisensory method supplementation.

The limited classroom time available to the researcher for providing intervention instruction also potentially limited to the results this study. The researcher was provided 15 minutes, three times a week to conduct her part of the intervention. However, the treatment classroom teachers were given sufficient time to supplement the instruction through additional reinforcement of the multisensory methods by following an implementation checklist developed by the researcher. Due to the time constraints, the extent of multisensory methods that could be used to supplement the phonics skills being taught was reduced, which potentially limited the full impact the treatment could have on the students' skills.

When assessing potential impact of the intervention between students in the above and below 50th percentile relative to their peers, the number of students in these sample sizes was small. To compute the above and below 50th percentile, each class was divided into half. Students were either placed in the upper half or lower half depending on their total reading scores on the Stanford Achievement Test. This cut the overall sample size in half. A larger sample size could provide a closer representation of the sample mean to the population mew.

Implications for the Study

An analysis of the study results suggest several implications for early elementary educators to consider. First, educators should consider reviewing their school's phonics program and consider whether specific components of multisensory language instruction could be added to better meet the needs of all learners within the classroom. The systematic and explicit method of teaching letter-sound correspondences, a major component of multisensory instruction, provides young students with a clear understanding of the connection between written language and spoken language. Implementing such an approach, or elements of it, would include ensuring a step-by-step procession from the introduction of isolated sounds that ends with the reading of controlled texts. As sounds are introduced, pictures with associated keywords should be provided for the students. Students learn to associate the name of the letter(s) with a specific keyword picture and the sound that it makes. As students learn to blend the sounds into words, the sounds should be color coded initially (e.g. yellow for consonants, pink for vowels) in order to help the students develop their phonemic awareness and their understanding of the phoneme-grapheme correspondence. As students practice reading words, they should have opportunity to identify the specific sounds within words and be taught a marking system to mark the sounds within the words (e.g., placing a box around welded sounds). Using controlled text (such as a basal reader) to apply these concepts provides further reinforcement for the phonics skills that the students are learning.

Encoding instruction should also be considered a vital part of a systematic and explicit phonics program in grades K-2. The results of this study revealed significant outcomes in favor of the treatment group in their ability to spell words correctly on the encoding test. The additional component of encoding skills to decoding skills provides bi-directional instruction which reinforces and solidifies the letter-sound associations. The treatment group results were also significant in decoding and approached significance in oral reading fluency, thereby providing further evidence of the benefits of encoding instruction to the recognition of the grapheme-phoneme correspondence. As each new sound is introduced and the students are given words with these new sounds, they should have the opportunity to review the phoneme-grapheme correspondence through spelling.

Providing kinesthetic-tactile elements, such as finger-tapping, manipulation of letter tiles, and speaking the letters and words as they are written should be integrated into the encoding and decoding components of a phonics program. Because there is an increasing array of student abilities and learning styles entering the classrooms, it is imperative that the educator provide instruction to meet each individual needs. By adding in components that tie in the different senses to instruction, the educator is helping children with those various learning styles to create and reinforce brain pathways that will aid in understanding of the letter-sound correspondence.

Teachers of students within the younger grades need to receive instruction on the theory and background of multisensory methods and their practical application within the classroom. Multisensory language instruction provides the teacher with a greater understanding of the process of reading acquisition that occurs within the brain and provides a vast array of tools that the teacher can access to help the different learners meet core reading objectives by the end of the school year.

Recommendations for Further Research

The alarming statistics provided by the NCES in 2013 revealed that over 33% of our nation's fourth graders are reading at or below the Basic reading level on the national reading assessment. Given the results of this and other studies presented in this dissertation, there is a strong potential for multisensory language instruction to fill in some of the learning gaps that are creating such a statistic, but there is a need for further research to validate its effectiveness within the regular classroom. Therefore, this study proposes the need for further research in the following areas:

1. This study could be replicated over a period of two to three years rather than just 12 weeks. It would be helpful to follow a treatment group from first through third grade to determine the treatment's long term effects rather than just the immediate effects of the intervention.
2. Further studies using a larger sample size that could be better divided into top 25^{th} percentile, middle 50^{th} percentile, and bottom 25^{th} percentile would further clarify the results that were revealed in this study in order to better ascertain its results on above average, average, and below average readers.
3. Studies across different schools using the same basal reading curriculum would also provide a greater variety of students within the sample in order to better generalize the results to the population.

4. Further research on the integration of multisensory methods that are directly correlated to the phonics skills covered in a basal reading curriculum would provide more relevant information in its value in meeting the needs of the individual students, and would provide further information on how to better develop a multisensory curriculum that can appropriately supplement an already-established basal reading curriculum.
5. Further research that added in some qualitative components, such as student attitudes towards reading after the multisensory intervention, and teacher attitudes following their own training in multisensory methods and their application of it within the classroom, would also be beneficial. This research would provide information from the perspective of the individuals (student and teacher) involved in the intervention in order to better determine how to improve the program.

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APPENDICES

APPENDIX A

DISSERTATION STUDY PLAN

<u>Classroom Implementation</u>

- Researcher (me) will teach the two treatment group classes
- Additional supplemental multisensory instruction- 15-20 min/day; 3 times a week for 12 weeks by researcher and reinforcement multisensory instruction following an implementation checklist by the classroom teachers of the treatment group
- This instruction will be given in addition to the BJ Reading curriculum.
- Researcher-created lessons plans will use multisensory strategies to teach phonics skills (that directly relate to the BJ basal readers). Lesson plans indicate which mode of instruction to use on which day.
- Multisensory Instruction: Decoding and Encoding
- Decoding instruction
    - *Drill sounds* – letters with pictures are displayed, students do a drill giving the name-keyword-sound of each letter(s).
    - *Sound cards*- cards with letters representing each sound in a word are displayed (Ex: c-ar-d). Students "tap out" sounds using their fingers and "wrap it up" with their hand to read the word.

- *Word cards*- after tapping out words using sound cards, students practice reading words containing the same sounds. Additional activities involving
- students "marking up" sounds in the word cards or "categorizing" word cards according to their special sounds will be implemented.

- Encoding instruction
  - *Magnetic letter boards*- these contain magnetic tiles of all of the letters in the alphabet and special sound letters (Ex: ai, sh, ing). The teacher gives the students a word, students repeat the word, tap out the sounds in the word, and pull out the matching letter tiles that go with each sound.
  - *Dry-erase boards*- teacher dictates a word and students repeat word, tap out sounds in word, and write the word (marking up the special sounds in the word)
- Testing student progress
  - Researcher-created decoding and encoding tests and standardized oral reading fluency tests will be given to all first grade students at the beginning and end of the study.
  - Evaluate and compare student progress in control group and experimental group on subtests of:
    - ✓ **Decoding**- word identification, word attack (alphabetic principle-phonological awareness/phonemic awareness)
    - ✓ **Encoding**- spelling ability; phonics points (sound to symbol correspondence)
    - ✓ **Oral Reading Fluency-** reading accuracy and reading rate

APPENDIX B

PARENT OPT OUT FORM

Request to OPT OUT of Research Study Assessments

Description of the research and your child's participation

My name is Christina Sprout and I am the reading tutor at Bob Jones Academy. I will be conducting a dissertation research study in several of the first grade classrooms this school year. The purpose of this research is to measure the effects of using multisensory instruction to systematically teach phonics concepts related to the Bob Jones Press reading curriculum on students' progress in several reading-related skills.

During the course of the study, I will be going into specified classrooms and teaching the supplemental multisensory instruction three times a week for 15-20 minutes throughout a portion of this school year. All data compiled from the assessments will not mention your child's name, and all information gathered on your child will be kept confidential.

Potential Benefits

The use of systematic multisensory language instruction as a supplement to reading instruction has been increasingly used for children having difficulty learning to read. The goal of this research is to gauge the extent to which implementing these techniques impacts struggling and non-struggling students' reading and spelling abilities when they are used in conjunction with the regular classroom reading curriculum.

Voluntary Participation

All first grade students will be participating in this study in one capacity or another, whether in a treatment group (where multisensory methods will be used) or in a control group (where traditional classroom curriculum will be used without additional multisensory instruction). Use of your child's assessments will help provide important statistical information. If you wish for your child NOT to be assessed with my study-specific assessments during the course of this study you may do so. To OPT OUT, please complete and return the form below by *Monday, October 21;* otherwise it will be assumed that you grant permission for your child to be assessed and for his or her results to be included in the statistical analysis I develop from the study. If you have any questions or concerns, please contact me at 370-1800 ext. 6230 or csprout@bobjonesacademy.net

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OPT-OUT Request Form

To opt your child out from research study assessments, please sign and return this form by Monday, October 21.

I wish to OPT OUT my child,____________________________, in _____________________‘s class, (Classroom Teacher’s Name) from taking study-specific assessments during the course of the dissertation research study conducted by doctoral candidate Christina Sprout.

Parent Signature ____
Date__________________

APPENDIX C

IMPLEMENTATION CHECKLIST

for Classroom Teachers

<table>
<tr><td>Monday</td><td>Drill sounds
(1 min.) ______</td><td>Tap out sounds in
words (decoding)
(2 min.) ______</td><td rowspan="2">Spelling Words
using magnetic
letter boards
(encoding) (5 min.)
______</td></tr>
<tr><td>Tuesday</td><td>Drill Sounds
(1 min.) ______</td><td>Tap out sounds in
words (decoding)
(2 min.) ______</td></tr>
<tr><td>Wednesday</td><td>Drill Sounds
(1 min.) ______</td><td>Tap out sounds in
words (decoding)
(2 min.) ______</td><td rowspan="3">Encoding Checkup
(7 min.) ______</td></tr>
<tr><td>Thursday</td><td>Drill Sounds
(1 min.) ______</td><td>Tap out sounds in
words (decoding)
(2 min.) ______</td></tr>
<tr><td>Friday</td><td>Drill Sounds
(1 min.) ______</td><td>Tap out sounds in
words (decoding)
(2 min.) ______</td></tr>
</table>

APPENDIX D

DECODING WORD IDENTIFICATION PRETEST AND POSTTEST EVALUATOR FORMS

Pretest Word Identification Evaluator Form

1. sit ____
2. had ____
3. ten ____
4. fan ____
5. ramp ____
6. log ____
7. tend ____
8. bent ____
9. tab ____
10. spot ____
11. rust ____
12. belt ____
13. mask ____
14. quick ____
15. chug ____
16. lush ____
17. whip ____
18. best____
19. stop____
20. ring____
21. bank____
22. hung____
23. think____
24. blank____
25. sample____
26. thimble____
27. spunk____
28. bundle____
29. handle____
30. lashes____
31. spinning____
32. running____
33. hotter____
34. filler____
35. middle____
36. skunks____
37. jumped____
38. stopped____
39. buzzed____
40. skimmed _
41. bobcat____
42. stinkbug____
43. shellfish____
44. batted____
45. sale____
46. hide____
47. pail____
48. rope____
49. mute____
50. tail____
51. jeep____
52. key ____
53. beach ____
54. pie ____
55. cry ____
56. light ____
57. float ____
58. no ____
59. ice ____
60. clown ____
61. face ____
62. star ____
63. glue ____
64. fern ____
65. we ____
66. horn ____
67. true ____
68. spur ____
69. steep ____
70. shirt ____
71. sport ____
72. spoon ____
73. book ____
74. town ____
75. ground ____
76. sage ____
77. huge ____
78. spoil ____
79. toy ____
80. fawn ____
81. haul ____
82. sludge ____
83. badge ____
84. stitch ____

Posttest Word Identification Evaluator Form

1. lid ____
2. mad ____
3. peg ____
4. tan ____
5. lamp ____
6. hog ____
7. send ____
8. rant ____
9. bad ____
10. spun ____
11. bust ____
12. felt ____
13. task ____
14. quill ____
15. chum ____
16. shop ____
17. when ____
18. rest ____
19. stick ____
20. thing ____
21. sank ____
22. lung ____
23. wink ____
24. plank ____
25. dimple ____
26. rumble ____
27. dunk ____
28. muddle ____
29. settle ____
30. dashes ____
31. fanning ____
32. hitting ____
33. sadder ____
34. sticker ____
35. simple ____
36. trunks ____
37. stamped ____
38. tipped ____
39. fanned ____
40. bobbed ____
41. handbag ____
42. within ____
43. sandbox ____
44. patted ____
45. tale ____
46. ride ____
47. wail ____
48. hope ____
49. flute ____
50. bait ____
51. sleep ____
52. key ____
53. reach ____
54. tie ____
55. fly ____
56. sight ____
57. throat ____
58. so ____
59. rice ____
60. town ____
61. lace ____
62. harm ____
63. true ____
64. fern ____
65. he ____
66. born ____
67. sue ____
68. burn ____
69. beep ____
70. dirt ____
71. horn ____
72. zoom ____
73. took ____
74. gown ____
75. sound ____
76. page ____
77. huge ____
78. hoist ____
79. soy ____
80. dawn ____
81. haul ____
82. fudge ____
83. bridge ____
84. patch ____

APPENDIX E

DECODING WORD ATTACK PRETEST AND POSTTEST EVALUATOR FORM

Pretest Word Attack Evaluator Form

1. bim ___/3	15. mug ___/3	29. tate ___/3	43. horb ___/3
2. pac ___/3	16. losh ___/3	30. lide ___/3	44. barm ___/3
3. sen ___/3	17. whid ___/3	31. paib ___/3	45. terb ___/3
4. zan ___/3	18. kest ___/4	32. teep ___/3	46. lurm ___/3
5. tamp ___/4	19. zep ___/3	33. fie ___/2	47. baud ___/3
6. vot ___/3	20. stod ___/4	34. dight ___/3	48. mudge ___/3
7. pent ___/4	21. ming ___/2	35. moe ___/2	49. fitch ___/3
8. wend ___/4	22. mag ___/3	36. vue ___/2	50. toim ___/3
9. tosp ___/4	23. lank ___/2	37. beaz ___/3	51. sout ___/3
10. mest ___/4	24. jung ___/2	38. tay ___/2	52. lutch ___/3
11. velt ___/4	25. fen ___/3	39. fice ___/3	53. pudge ___/3
12. chid ___/3	26. vonk ___/2	40. trow ___/3	54. quim ___/3
13. sug ___/3	27. zun ___/3	41. pirt ___/3	
14. quid___/3	28. thid___/3	42. peb___/3	

Color coding assists the evaluator in signifying each individual sound.

Posttest Word Attack Evaluator Form

1. lim ___/3
2. paf ___/3
3. sev ___/3
4. lan ___/3
5. zamp ___/4
6. mox ___/3
7. pent ___/4
8. yend ___/4
9. rosp ___/4
10. yest ___/4
11. helt ___/4
12. chig ___/3
13. mig ___/3
14. quim___/3
15. lug ___/3
16. tosh ___/3
17. whib ___/3
18. mest ___/4
19. bep ___/3
20. stom ___/4
21. ling ___/2
22. dag ___/3
23. pank ___/2
24. cung ___/2
25. feg ___/3
26. tonk ___/2
27. zup ___/3
28. thib___/3
29. wate ___/3
30. lipe ___/3
31. paim ___/3
32. teed ___/3
33. zie ___/2
34. vight ___/3
35. roe ___/2
36. lue ___/2
37. meaz ___/3
38. fay ___/2
39. bice ___/3
40. stow ___/3
41. lirt ___/3
42. leb___/3
43. torm ___/3
44. parm ___/3
45. werb ___/3
46. furm ___/3
47. baug ___/3
48. ludge ___/3
49. metch ___/3
50. moit ___/3
51. soud ___/3
52. yutch ___/3
53. ludge ___/3
54. qued ___/3

Color coding assists the evaluator in signifying each individual sound.

APPENDIX F

ENCODING PRETEST AND POSTTEST EVALUATOR FORMS

This was a researcher-created assessment measuring students' encoding abilities, which requires the ability to discern language by segmenting sounds (phonemes) and translating them to letters (graphemes).

Encoding Pretest Evaluator Form, page 1

	ID Number: ____________			Words Spelled Correctly: ___/60		Phonics Points: ____/186			Total: ___/246			Group 1	Group 2		
Spelling Words	Consonants Beginning	Consonants Final	Short vowel	Blend	Digraph	Glued sound	Long vowel	Diphthong	Consonant-le	Suffixes	Doubled consonant	Soft c; soft g	r-controlled	Trigraphs	Phonics points	Spelled correctly
1. wept	w		e	pt											/3	
2. melt	m		e	lt											/3	
3. hint	h		i	nt											/3	
4. stash			a	st	sh										/3	
5. champ			a	mp	ch										/3	
6. whip		p	i		wh (w)										/3	
7. thin		n	i		th										/3	
8. sting				st		ing									/2	
9. rank	r					ank									/2	
10. song	s					ong									/2	
11. quit		t	i		qu										/3	
12. flung				fl		ung									/2	
13. honk	h					onk									/2	
14. thing					th	ing									/2	
15. fumble	f	m	u						ble						/4	

(continued)

Encoding Pretest Evaluator Form, page 2

	ID Number: ____________			Words Spelled Correctly: ___/60		Phonics Points: ____			/186	Total: ___	/246		Group 1	Group 2		
Spelling Words	Consonants Beginning	Consonants Final	Short vowel	Blend	Digraph	Glued sound	Long vowel	Diphthong	Consonant-le	Suffixes	Doubled consonant	Soft c; soft g	r-controlled	Trigraphs	Phonics points	Spelled correctly
16. handle	h	n	a						dle						/4	
17. simple	s	m	i						ple						/4	
18. hopping	h	p	o							ing	p				/5	
19. setting	s	t	e							ing	t				/5	
20. funded	f		u	nd						ed					/4	
21. sticker			i	st	ck					er					/4	
22. jumped	j		u	mp						ed					/4	
23. stopped		p	o	st						ed	p				/5	
24. faster	f		a	st						er					/4	
25. boxes	b	o	x							es					/4	
26. pots	p	t	o							s					/4	
27. rope	r	p	o				o-e (oa)								/4	
28. bite	b			t			i-e								/3	
29. laid	l	d					ai (a-e)								/3	
30. seed	s	d					ee (ea/e-e)								/3	
Total	/20	/14	/21	/13	/7	/6	/4	---	/3	/9	/3	---	---	---	/100	/30

(continued)

Encoding Pretest Evaluator Form, page 3

Spelling Words	Consonants Beginning	Consonants Final	Short vowel	Blend	Digraph	Glued sound	Long vowel	Diphthong	Consonant-le	Suffixes	Doubled consonant	Soft c; soft g	r-controlled	Trigraphs	Phonics points	Spelled correctly
31. slight		t		sl			igh (i-e)								/3	
32. pie	p						ie (i)								/2	
33. round	r			nd				ou							/3	
34. town	t	n						ow							/3	
35. clown		n		cl				ow							/3	
36. mount	m			nt				ou							/3	
37. slow				sl				ow (oe)							/2	
38. void	v	d						oi							/3	
39. soy	s							oy							/2	
40. moist	m			st				oi							/3	
41. joy	j							oy							/2	
42. sage	s						a-e					g			/3	
43. lice	l						i-e					c			/3	
44. huge	h						u-e					g			/3	
45. pace	p						a-e					c			/3	

(continued)

Encoding Pretest Evaluator Form, page 4

Spelling Words	Consonants		Short vowel	Blend	Digraph	Glued sound	Long vowel	Diphthong	Consonant-le	Suffixes	Doubled consonant	Soft c; soft g	r-controlled	Trigraphs	Phonics points	Spelled correctly
	Beginning	Final														
46. turn	t	n											ur (er/ir)		/3	
47. harm	h	m											ar		/3	
48. dirt	d	t											ir (er/ur)		/3	
49. ford	f	d											or		/3	
50. fern	f	n											er (ur/ir)		/3	
51. born	b	n											or		/3	
52. lawn	l	n						aw (au)							/3	
53. haul	h	l						au (all/aw)							/3	
54. boom	b	m						oo							/3	
55. hood	h	d						oo							/3	
56. soon	s	n						oo							/3	
57. fudge	f		u											dge	/3	
58. sledge			e	sl										dge	/3	
59. catch	c		a											tch	/3	
60. hitch	h		i											tch	/3	
Total/	/26	/15	/4	/7	---	---	/6	/14	---	---	---	/4	/6	/4	/86	/30
Grand Total	/46	/29	/25	/20	/7	/6	/10	/14	/3	/9	/3	/4	/6	/4	/186	/60

(continued)

Encoding Posttest Evaluator Form, page 1

Above / Below 50th				Words Spelled Correctly: ___/60			Phonics Points: ___/185			Total: ___/246			Treatment		Control	
Spelling Words	Consonants Beginning	Consonants Final	Short vowel	Blend	Digraph	Glued sound	Long vowel	Diphthong	Consonant-le	Suffixes	Doubled consonant	Soft c; soft g	r-controlled	Trigraphs	Phonics Points	Spelled correctly
1. slip		p	i	sl											/3	
2. belt	b		e	lt											/3	
3. tent	t		e	nt											/3	
4. smash			a	sm	sh										/3	
5. chum		m	u		ch										/3	
6. when		n	e		wh (w)										/3	
7. path	p		a		th										/3	
8. sling				sl		ing									/2	
9. bank	b					ank									/2	
10. long	l					ong									/2	
11. quick			i		qu, ck										/3	
12. stung				st		ung									/2	
13. honk	h					onk									/2	
14. sting				st		ing									/2	
15. humble	h	m	u						ble						/4	

(continued)

Encoding Posttest Evaluator Form, page 2

Above / Below 50th				Words Spelled Correctly: ___/60			Phonics Points: ___/185			Total: ___/246			Treatment		Control	
Spelling Words	Consonants Beginning	Final	Short vowel	Blend	Digraph	Glued sound	Long vowel	Diphthong	Consonant le	Suffixes	Doubled consonant	Soft c; soft g	r-controlled	Trigraphs	Phonics Points	Spelled correctly
16. sandle	s	n	a						dle						/4	
17. dimple	d	m	i						ple						/4	
18. running	r	n	u							ing	n				/5	
19. hitting	h	t	i							ing	t				/5	
20. banded	b		a	nd						ed					/4	
21. blacker			a	bl	ck					er					/4	
22. jumped	j		u	mp						ed					/4	
23. hopped	h	p	o							ed	p				/5	
24. duster	d		u	st						er					/4	
25. foxes	f		o	x						es					/4	
26. hats	h	t	a							s					/4	
27. hole	h	l					o-e (oa)								/3	
28. bite	b	t					i-e (igh)								/3	
29. paid	p	d					ai (a-e)								/3	
30. seed	s	d					ee (ea/e-e)								/3	
Total	/21	/14	/20	/12	/7	/6	/4	---	/3	/9	/3	---	---	---	/99	/30

(continued)

Encoding Posttest Evaluator Form, page 3

Spelling Words	Consonants Beginning	Consonants Final	Short vowel	Blend	Digraph	Glued sound	Long vowel	Diphthong	Consonant-le	Suffixes	Doubled consonant	Soft c; soft g	r-controlled	Trigraphs	Phonics Points	Spelled correctly
31. flight		t		fl			igh (i-e)								/3	
32. tie	t						ie (i)								/2	
33. hound	h			nd				ou (ow)							/3	
34. down	d	n						ow (ou)							/3	
35. clown		n		cl				ow (ou)							/3	
36. pout	p	t						ou (ow)							/3	
37. glow				gl				ow (oe)							/2	
38. toil	t	l						oi (oy)							/3	
39. boy	b							oy (oi)							/2	
40. moist	m			st				oi (oy)							/3	
41. toy	t							oy (oi)							/2	
42. rage	r						a-e					g			/3	
43. nice	n						i-e					c			/3	
44. huge	h						u-e					g			/3	
45. lace	l						a-e					c			/3	

(continued)

Encoding Posttest Evaluator Form, page 4

Spelling Words	Consonants Beginning	Consonants Final	Short vowel	Blend	Digraph	Glued sound	Long vowel	Diphthong	Consonant-le	Suffixes	Doubled consonant	Soft c; soft g	r-controlled	Trigraphs	Phonics Points	Spelled correctly
46. burn	b	n											ur (er/ir)		/3	
47. harp	h	p											ar		/3	
48. bird	b	d											ir (er/ur)		/3	
49. fort	f	t											or		/3	
50. fern	f	n											er (ur/ir)		/3	
51. torn	t	n											or		/3	
52. fawn	f	n						aw (o/au)							/3	
53. laud	l	d						au (o/aw)							/3	
54. boot	b	t						oo							/3	
55. good	g	d						oo							/3	
56. soon	s	n						oo							/3	
57. hedge	h		e											dge	/3	
58. badge	b		a											dge	/3	
59. pitch	p		i											tch	/3	
60. match	m		a											tch	/3	
Total	/27	/16	/4	/5	---	---	/6	/14	---	---	---	/4	/6	/4	/86	/30
Grand Total	/48	/30	/24	/17	/7	/6	/10	/14	/3	/9	/3	/4	/6	/4	/185	/60

APPENDIX G

DECODING WORD IDENTIFICATION PRETEST AND POSTTEST SPLIT HALVES RELIABILITY TEST

Decoding Word Identification Pretest

Case Processing Summary			
		N	%
Case	Valid	10	100.0
	Excluded[a]	0	.0
	Total	10	100.0

a. Listwise deletion based on all variables in the procedure.

Reliability Statistics		
	Total N of Items	2
Correlation Between Forms		.709
Spearman-Brown Coefficient	Equal Length	.829
	Unequal Length	.829
Guttman Split-Half Coefficient		.825

Inter-Item Correlation Matrix		
	odd	even
odd	1.000	.709
even	.709	1.000

Decoding Word Identification Posttest

Case Processing Summary			
		N	%
Case	Valid	10	100
	Excluded[a]	0	0
	Total	10	100

a. Listwise deletion based on all variables in the procedure.

Reliability Statistics		
	Total N of Items	2
Correlation Between Forms		.905
Spearman-Brown Coefficient	Equal Length	.950
	Unequal Length	.950
Guttman Split-Half Coefficient		.945

Inter-Item Correlation Matrix		
	odd	even
odd	1.000	.905
even	.905	1.000

APPENDIX H

DECODING WORD ATTACK PRETEST AND POSTTEST SPLIT HALVES RELIABILITY TEST

Decoding Word Attack Pretest

Case Processing Summary			
		N	%
Case	Valid	10	100
	Excluded[a]	0	0
	Total	10	100

a. Listwise deletion based on all variables in the procedure.

Reliability Statistics		
	Total N of Items	2
Correlation Between Forms		.790
Spearman-Brown Coefficient	Equal Length	.882
	Unequal Length	.882
Guttman Split-Half Coefficient		.882

Inter-Item Correlation Matrix		
	odd	even
odd	1.000	.790
even	.790	1.000

Decoding Word Attack Posttest

Case Processing Summary			
		N	%
Case	Valid	10	100
	Excluded[a]	0	0
	Total	10	100

a. Listwise deletion based on all variables in the procedure.

Reliability Statistics		
	Total N of Items	2
Correlation Between Forms		.731
Spearman-Brown Coefficient	Equal Length	.845
	Unequal Length	.845
Guttman Split-Half Coefficient		.845

Inter-Item Correlation Matrix		
	odd	even
odd	1.000	.731
even	.731	1.000

APPENDIX I

ENCODING PRETEST AND POSTTEST SPLIT HALVES RELIABILITY TEST

Encoding Pretest

Case Processing Summary			
		N	%
Case	Valid	10	100
	Excluded[a]	0	0
	Total	10	100

a. Listwise deletion based on all variables in the procedure.

Reliability Statistics		
	Total N of Items	2
Correlation Between Forms		.745
Spearman-Brown Coefficient	Equal Length	.854
	Unequal Length	.854
Guttman Split-Half Coefficient		.827

Inter-Item Correlation Matrix		
	odd	even
odd	1.000	.745
even	.745	1.000

Encoding Posttest

Case Processing Summary			
		N	%
Case	Valid	10	100
	Excluded[a]	0	0
	Total	10	100

a. Listwise deletion based on all variables in the procedure.

Reliability Statistics		
	Total N of Items	2
Correlation Between Forms		.603
Spearman-Brown Coefficient	Equal Length	.752
	Unequal Length	.752
Guttman Split-Half Coefficient		.739

Inter-Item Correlation Matrix		
	odd	even
odd	1.000	.603
even	.603	1.000

APPENDIX J

DECODING WORD IDENTIFICATION PRETEST AND POSTTEST INTER RATER RELIABILITY

Decoding Word Identification Pretest

Case Processing Summary			
		N	%
Case	Valid	10	100
	Excluded[a]	0	0
	Total	10	100

a. Listwise deletion based on all variables in the procedure.

Reliability Statistics	
Cronbach's Alpha	N of Items
.980	2

Intraclass Correlation Coefficient							
	Intraclass Correlation[b]	95% Confidence Interval		F Test with True Value 0			
		Lower Bound	Upper Bound	Value	df1	df2	Sig.
Simple Measures	.960[a]	.856	.990	49.312	9	9	.000
Average Measures	.980[c]	.923	.995	49.312	9	9	.000

Two-way mixed effects model where people effects are random and measures effects are fixed.

a. The estimator is the same, whether the interaction effect is present or not.

b. Type A intraclass correlation coefficients using an absolute agreement definition.

c. This estimate is computed assuming the interaction effect is absent, because it is not estimable otherwise.

Decoding Word Identification Posttest

Case Processing Summary			
		N	%
Case	Valid	10	100
	Excluded[a]	0	0
	Total	10	100

a. Listwise deletion based on all variables in the procedure.

Reliability Statistics	
Cronbach's Alpha	N of Items
.996	2

Intraclass Correlation Coefficient							
	Intraclass Correlation[b]	95% Confidence Interval		F Test with True Value 0			
		Lower Bound	Upper Bound	Value	df1	df2	Sig.
Simple Measures	.991[a]	.952	.998	284.248	9	9	.000
Average Measures	.995[c]	.976	.999	284.248	9	9	.000

Two-way mixed effects model where people effects are random and measures effects are fixed.

a. The estimator is the same, whether the interaction effect is present or not.

b. Type A intraclass correlation coefficients using an absolute agreement definition.

c. This estimate is computed assuming the interaction effect is absent, because it is not estimable otherwise.

APPENDIX K

DECODING WORD ATTACK PRETEST AND POSTTEST INTER RATER RELIABILITY

Decoding Word Attack Pretest

Case Processing Summary			
		N	%
Case	Valid	10	100.0
	Excluded[a]	0	0
	Total	10	100.0

a. Listwise deletion based on all variables in the procedure.

Reliability Statistics	
Cronbach's Alpha	N of Items
.997	2

Intraclass Correlation Coefficient							
	Intraclass Correlation[b]	95% Confidence Interval		F Test with True Value 0			
		Lower Bound	Upper Bound	Value	df1	df2	Sig.
Simple Measures	.994[a]	.976	.998	297.552	9	9	.000
Average Measures	.997[c]	.988	.999	297.552	9	9	.000

Two-way mixed effects model where people effects are random and measures effects are fixed.

a. The estimator is the same, whether the interaction effect is present or not.

b. Type A intraclass correlation coefficients using an absolute agreement definition.

c. This estimate is computed assuming the interaction effect is absent, because it is not estimable otherwise.

Decoding Word Attack Posttest

Case Processing Summary			
		N	%
Case	Valid	10	100
	Excluded[a]	0	0
	Total	10	100

a. Listwise deletion based on all variables in the procedure.

Reliability Statistics	
Cronbach's Alpha	N of Items
.997	2

Intraclass Correlation Coefficient							
	Intraclass Correlation[b]	95% Confidence Interval		F Test with True Value 0			
		Lower Bound	Upper Bound	Value	df1	df2	Sig.
Simple Measures	.992[a]	.960	.998	306.905	9	9	.000
Average Measures	.996[c]	.980	.999	306.905	9	9	.000

Two-way mixed effects model where people effects are random and measures effects are fixed.

a.The estimator is the same, whether the interaction effect is present or not.

b. Type A intraclass correlation coefficients using an absolute agreement definition.

c.This estimate is computed assuming the interaction effect is absent, because it is not estimable otherwise.

APPENDIX L

ORAL READING FLUENCY PRETEST AND POSTTEST INTER RATER RELIALBITY

Oral Reading Fluency Pretest

Case Processing Summary			
		N	%
Case	Valid	10	100
	Excluded[a]	0	0
	Total	10	100

a. Listwise deletion based on all variables in the procedure.

Reliability Statistics	
Cronbach's Alpha	N of Items
.997	2

Intraclass Correlation Coefficient							
	Intraclass Correlation[b]	95% Confidence Interval		F Test with True Value 0			
		Lower Bound	Upper Bound	Value	df1	df2	Sig.
Simple Measures	.995[a]	.980	.999	354.067	9	9	.000
Average Measures	.997[c]	.990	.999	354.067	9	9	.000

Two-way mixed effects model where people effects are random and measures effects are fixed.

a. The estimator is the same, whether the interaction effect is present or not.

b. Type A intraclass correlation coefficients using an absolute agreement definition.

c. This estimate is computed assuming the interaction effect is absent, because it is not estimable otherwise.

Oral Reading Fluency Posttest

Case Processing Summary			
		N	%
Case	Valid	10	100.0
	Excluded[a]	0	.0
	Total	10	100.0

a. Listwise deletion based on all variables in the procedure.

Reliability Statistics	
Cronbach's Alpha	N of Items
.999	2

Intraclass Correlation Coefficient							
	Intraclass Correlation[b]	95% Confidence Interval		F Test with True Value 0			
		Lower Bound	Upper Bound	Value	df1	df2	Sig.
Simple Measures	.998[a]	.993	1.000	996.400	9	9	.000
Average Measures	.999[c]	.996	1.000	996.400	9	9	.000

Two-way mixed effects model where people effects are random and measures effects are fixed.

a. The estimator is the same, whether the interaction effect is present or not.

b. Type A intraclass correlation coefficients using an absolute agreement definition.

c. This estimate is computed assuming the interaction effect is absent, because it is not estimable otherwise.

APPENDIX M

SCRIPT FOR ENCODING SUBTEST

"I am going to ask you to spell some words. Spell them the best you can. Some of the words will be easy to spell; some may be difficult. I will say each word one time, use it in a sentence, and repeat the word. Listen carefully to each sound in the word. If you don't know how to spell a word, spell it the best you can and write down all the sounds you hear.

1. The words may be repeated after they are used in the sentence as many times as needed so that every child understands the word.
2. For #18-26, please give the baseword and then the entire word (including the suffix) each time you say the word (Ex: "hop"- "hopping").

Words for Pretest

1. "wept"- The child wept after falling down and scraping his knee. - "wept"
2. "melt"- The chocolate will melt in the sun. - "melt"
3. "hint"- I will give you a hint to figure out the answer. - "hint"
4. "stash"- The stash of candy is on the top shelf. - "stash"
5. "champ"- The champ received a medal for winning the race. - "champ"
6. "whip"- The whip cracked loudly as the man flung it around. - "whip"
7. "thin"- The little girl got a thin slice of cheese from the fridge. - "thin"

8. “sting”- A bee sting can hurt quite badly. - “sting”
9. “rank”- The officer has a high rank in the military. - “rank”
10. “song”- I love to listen to my little girl, Mikayla, sing a song. - “song”
11. “quit”- Don’t quit when it gets hard. - “quit”
12. “flung”- Braden flung the ball across the room to hit the target. - “flung”
13. “honk”- We heard the geese honk as they crossed the road. - “honk”
14. “thing”- What is that thing on the floor? - “thing”
15. “fumble”- The players had a fumble with the ball during the game. - “fumble”
16. “handle”- Turn the door handle to come inside. - “handle”
17. “simple”- That is a simple job for a little child. - “simple”
18. “hopping”- The rabbit was hopping along in the grass. - “hopping”
19. “setting”- Setting the table was one of Sophie’s chores. - “setting”
20. “funded”- The state funded the program with tax dollars. - “funded”
21. “sticker”- Jill loves the princess sticker that I gave her. - “sticker”
22. “jumped”- Ethan jumped so high, I thought he would go through the clouds. - “jumped”
23. “stopped”- Jacob stopped when he heard his mommy call him. - “stopped”
24. “faster”- Peyton ran faster than all the boys in his class. - “faster”
25. “boxes”- We packed all of our toys into boxes as we prepared to move. - “boxes”
26. “pots”- Becky uses lots of pots and pans when she cooks in the kitchen. - “pots”
27. “pole”- The monkey climbed the pole all the way to the top. - “pole”
28. “bite”- Don’t try to pet a growling dog or he might bite you. - “bite”

29. “laid” – The child laid down on his bed and went to sleep. - “laid”
30. “seed”- We planted the flower seed in the ground and waited for it to grow. - “seed”
31. “slight”- He had a slight lead over the other runners throughout the race. - “slight”
32. “pie” – It will soon be Thanksgiving and we can eat some pumpkin pie. - “pie”
33. “round”- A circle is a round shape. - “round”
34. “town”- The town that we live in is very small. - “town”
35. “clown” – The clown at the circus was acting very silly. - “clown”
36. “mount”- We had to mount the shelf up on the wall to keep it from falling. - “mount”
37. “slow”- The tortoise was slow compared to the rabbit. - “slow”
38. “void”- We had to void the check because there was a mistake on it. - “void”
39. “soy” – Soy is found in many foods we eat. - “soy”
40. “moist” – The ground was moist after the rain. - “moist”
41. “joy”- The joy of the Lord is our strength. - “joy”
42. “sage”- Sage is a color that has some green in it. - “sage”
43. “lice”- We had to wash the hair with a special shampoo to get the lice out of it. - “lice”
44. “huge”- That is a huge elephant. - “huge”
45. “pace”- We ran a slow pace so the others could keep up with us. - “pace”
46. “turn”- Everyone needs to listen because it is Macy’s turn to speak. - “turn”

47. “harm”- Do not harm the kittens by picking them up and squeezing them too hard. “harm”

48. “dirt”- Many children love to play in the dirt. - “dirt”

49. “ford”- We waded in the ford of the river. - “ford”

50. “fern”- Tara hung a lovely green fern from her porch. - “fern”

51. “born”- Autumn had thick, black curls when she was born. - “born”

52. “lawn”- It is almost time to cut the lawn again. - “lawn”

53. “haul”- We had to haul away the dirt with a pick-up truck. - “haul”

54. “boom”- They heard a loud boom from the thunderstorm outside. - “boom”

55. “hood”- Put your hood up before going out into the snow. - “hood”

56. “soon”- We will be arriving soon to grandma’s house. - “soon”

57. “fudge”- We love to have fudge for dessert at Christmas. - “fudge”

58. “sledge”- Dad used a sledge hammer to break up the concrete. “sledge”

59. “catch”- Run after the ball and try to catch it before it hits the ground. – “catch”

60. “hitch”- We had to hitch up the horses to the wagon. – “hitch”

Words for Posttest

1. “slip” - Be careful not to slip on the ice. - “slip”
2. “belt” - He needs a brown belt with those pants. - "belt”
3. “tent” - We are bringing our tent to go camping. - “tent”
4. “smash” - We had to smash the coconut on the ground to get the milk. - “smash”
5. “chum” - A chum is a good friend. - “chum”
6. “when” - When will we get there? - “when”

7. “path” - The hiking path is steep and rocky. - “path”
8. “sling” - Emma had to have a sling for her broken arm. - “sling”
9. “bank” - Mom deposited the money in the bank. - “bank”
10. “long” - Jerry and I went for a long walk. - “long”
11. “quick” - That was a quick meeting! - “quick”
12. “stung” - Jonathan got stung by a bee - “stung”
13. “honk” - We heard the geese honk as they flew overhead. - “honk”
14. “sting” - That ant bite will sting for a while. - “sting”
15. “humble” - She is a very humble and kind person. - “humble”
16. “sandle” - I cannot find my sandle. - “sandle”
17. “dimple” - The baby has a large dimple on her cheek when she smiles. – “dimple”
18. “running” – Hank is running as fast as he can to get the soccer ball. - “running”
19. “hitting” – The boy is great at hitting the ball. – “hitting”
20. “banded” – The army banded together and marched forward. – “banded”
21. “blacker” – This yak is blacker than that yak. – “blacker”
22. “jumped” – Sophie jumped so high I thought she would get stuck up in the sky. – “jumped”
23. “hopped” – Samantha hopped on one leg because of her sore foot. – “hopped”
24. “duster” – We used a duster to clean the furniture. – “duster”
25. “foxes” – The foxes are running through the woods. – “foxes”
26. “hats” – The little girl loved to use her hats when playing ‘dress-up’. – “hats”
27. “hole” – Blaine dug a hole in the ground to plant the seed. – “hole”

28. “bite”- Annmarie took a big bite of chocolate cake. – “bite”

29. “paid” – The lady paid the boys for cleaning her car. – “paid”

30. “seed” – Grayson put the seed down into the hole that Blaine had dug. – “seed”

31. “flight” – The airplane flight took eight hours from Greenville to Honolulu. – “flight”

32. “tie” – Bryson had a coat and tie on for the Christmas program. – “tie”

33. “hound” – A hound dog has a very good sense of smell. – “hound”

34. “down” – Sally fell down when she was playing outside. – “down”

35. “clown” – We all love clown day. – “clown:

36. “pout” – It is not right to pout when we don’t get our way. “pout”

37. “glow” – Kristin knows how to make bracelets that glow. – “glow”

38. “toil” – To toil means to work hard at something. – “toil”

39. “boy” – Someday the little boy will grow into a tall man. – “boy”

40. “moist: - The dew made the ground moist in the early morning. – “moist”

41. “toy” – The toy store was crowded with parents doing last minute Christmas shopping- “toy”

42. “rage”- Rage is extreme anger. – “rage”

43. “nice” – My first grade teacher is very nice. – “nice”

44. “huge” – That was a huge bite of ice cream! – “huge”

45. “lace” – The lace along the edge of the dress was very pretty. – “lace”

46. “burn” – Blow on the hot chocolate before sipping it so you don’t burn your tongue. – “burn”

47. “harp” – We listened to the ladies play the harp at the program. “harp”

48. “bird” – Can you guess what kind of bird can repeat what we say? “bird”

49. “fort” – We built a tree fort in the backyard. – “fort”

50. “fern” – She hung a lovely fern from her front porch – “fern”

51. “torn” – The paper was torn in half. – “torn”

52. “fawn” – The baby fawn stayed close to its mother. – “fawn”

53. “laud” – We bestow laud and honor to Christ when we obey His Word. – “laud”

54. “boot” – A cowboy must have a cowboy boot to wear. – “boot”

55. “good” – Yummy! Those were good cookies. – “good”

56. “soon” – Get your coat on because we are leaving soon. – “soon”

57. “hedge” – We put a hedge up around the back yard. – “hedge”

58. “badge” – The soldier earned a special badge for his bravery. – “badge”

59. “pitch” – She could pitch the ball very fast. – “pitch”

60. “match” – The goal in the game is to find a match to your card. – “match”

APPENDIX N

DIRECTIONS FOR ADMINSTERING AND SCORING THE DECODING WORD ATTACK SUBTEST

Script for Administering the Decoding Word Attack Subtest

“Look at this word (show student the nonsense word). We call this a nonsense word, or a make-believe word. Watch as I read this word: ‘/m/ /i/ /b/’ (point under each letter as they are sounded out). I can say the sounds in this word: ‘/m/ /i/ /b/’, or I can read the entire word: “mib” (slide finger across the word while reading it).”

“Now it is your turn to read a nonsense word. Try your best to read this word (point to the nonsense word: “tev”) and say any sounds that you may know.”

Correct Response: /t/ /e/ /v/ or “tev”

Incorrect Response: If the child gives incorrect sounds or hesitates for more than three seconds

“Here are some nonsense words (point to student probe). Read the words the best you can. You may begin.”

Scoring for the Decoding Word Attack Subtest

Letter sounds. Students receive full credit if they sound out each individual phoneme within the word or if they read the entire word.

Partially correct words. Students only receive credit for the specific phonemes with each word that were pronounced correctly. Therefore, partial credit can be awarded for each word.

Repeated sounds. Repeated sounds are ignored.

Hesitations. Hesitations of more than three seconds are scored as incorrect. The evaluator may provide the word and encourage the student to read the next word.

Insertions. Insertions are ignored.

	Student Response	Student Score
Correct letter sound	/m/ /o/ /t/	3/3
Partially correct word	/m/ /i/ /t/	2/3
	/m/ /o/ /d/	2/3
Repeated Sounds	/m/ /o/ /t/ /t/	3/3
Hesitations of more than 3 seconds	/m/ /o/ (3 sec) Teacher Prompt: /t/,	2/3
Insertions	/m/ /o/ /s/ /t/	3/3

APPENDIX O

PILOT STUDY ANALYSIS FOR DECODING WORD IDENTIFICATION SUBTEST

Decoding Word Identification Subtest

T-Test

Group Statistics					
	Treatment	N	Mean	Std. Deviation	Std. Error Mean
Improvement Score	Control	5	-2.00	1.871	.837
	Treatment	5	2.40	4.037	1.806

Independent Samples Test										
		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Dif.	Std. Error Dif.	95 % Confidence Interval of the Difference	
									Lower	Upper
Improvement Score	Equal Variances Assumed	1.116	.322	-2.211	8	.058	-4.400	1.990	-8.989	.189
	Equal Variances Not Assumed			-2.211	5.642	.072	-4.400	1.990	-9.345	.545

APPENDIX P

PILOT STUDY ANALYSIS FOR THE DECODING WORD ATTACK SUBTEST

Decoding Word Attack Subtest

T-Test

Group Statistics					
	Treatment	N	Mean	Std. Deviation	Std. Error Mean
Improvement Score	Control	5	-1.40	4.615	2.064
	Treatment	5	3.20	4.266	1.908

Independent Samples Test										
		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Dif.	Std. Error Dif.	95 % Confidence Interval of the Difference	
									Lower	Upper
Improvement Score	Equal Variances Assumed	.013	.912	-1.637	8	.140	-4.600	2.811	-11.081	1.881
	Equal Variances Not Assumed			-1.637	7.951	.141	-4.600	2.811	-11.088	1.888

APPENDIX Q

PILOT STUDY ANALYSIS FOR ENCODING SUBTEST

Encoding Subtest—Words Spelled Correctly

T-Test

Group Statistics					
	Treatment	N	Mean	Std. Deviation	Std. Error Mean
Improvement Score	Control	5	3.00	3.937	1.761
	Treatment	5	7.00	4.637	2.074

Independent Samples Test										
		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Dif.	Std. Error Dif.	95 % Confidence Interval of the Difference	
									Lower	Upper
Improvement Score	Equal Variances Assumed	.291	.604	-1.470	8	.140	-4.000	2.720	-10.273	2.273
	Equal Variances Not Assumed			-1.470	7.795	.141	-4.000	2.720	-10.302	2.302

Encoding Subtest—Phonics Points

T-Test

Group Statistics					
	Treatment	N	Mean	Std. Deviation	Std. Error Mean
Improvement Score	Control	5	9.20	12.071	5.398
	Treatment	5	22.80	15.336	6.859

Independent Samples Test										
		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Dif.	Std. Error Dif.	95 % Confidence Interval of the Difference	
									Lower	Upper
Improvement Score	Equal Variances Assumed	.603	.406	-1.558	8	.488	-158	-13.600	-33.727	6.527
	Equal Variances Not Assumed			-1.558	7.581	.488	-160	-13.600	-33.922	7.222

APPENDIX R

PILOT STUDY ANALYSIS FOR ORAL READING FLUENCY SUBTEST

T-Test

Group Statistics					
	Treatment	N	Mean	Std. Deviation	Std. Error Mean
Improvement Score	Control	5	14.60	9.072	4.057
	Treatment	5	6.80	5.541	2.478

Independent Samples Test										
		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Dif.	Std. Error Dif.	95 % Confidence Interval of the Difference	
									Lower	Upper
Improvement Score	Equal Variances Assumed	1.766	.221	1.641	8	.139	7.800	4.754	-3.163	18.763
	Equal Variances Not Assumed			1.641	6.620	.147	7.800	4.754	-3.574	19.174

APPENDIX S

APPROVAL FOR STATISTICAL PROCEDURE

From: Dr. Gary Guthrie, Dr. Don Jacobs, Dr. Kathy Pilger, Dr. Sue Quindag, Dr. Melissa Gardenghi

To: Doctoral Candidate Using Statistics in His or Her Dissertation

Re: Statistical Procedures for Dissertation

This form is required for any prospectus that will involve statistical analysis of data. In some instances, one of the individuals cited above may be a committee chair or member and they may sign this form. If not, one of the individuals cited above must sign this form even though they are not a member of your committee. This signed form must be included in the appendixes of your prospectus. The steps shown must be completed **before the actual gathering of data.** Hence, no gathering of data and certainly no analysis of data are possible until your statistician and committee have approved the following steps:

Step 1: The definition of the problem.

Step 2: The statistical procedure(s) to be used on the data.

Step 3: The computation of the sample size.

Step 4: Plans for gathering the data. Please note that for a survey, the graduate education faculty require a minimum of a 50 percent return rate for the data to be viable. Hence, in a survey or questionnaire environment, plans must include appropriate follow-up procedures.

Step 5: Completion of a pilot study. In particular:

a. Using your questionnaire or gathering data in a trial situation
b. Using the statistical procedures from Step 2 to analyze your trial data
c. Justifying the sample-size formula from Step 3 to validate your sample size
d. Interpreting the pilot data to resolve your problem

Statistician: ____________________ Date: 12/9/13