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

by

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CHAPTER I

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 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 goals, 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 pull these children from the regular classroom into a separate classroom and provide more

individualized, small group reading instruction. 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 rate 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 that directly correlate 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. The purpose of this study then is to explore the effects of supplementing the traditional classroom reading and phonics curriculum with additional multisensory instructional methods and to measure the impact this has on student reading outcomes.

Spiritual Significance

The ability to read, and therefore to 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 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 2011, a staggering thirty-three percent of fourth grade public school students in the United States scored at or 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 have "partial mastery of fundamental skills" (NCES, 2013, p. 102) for proficient word knowledge at each grade assessed. 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. According to Bhat, Rapport, and Griffin (2000),

> While 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.

Description of Multisensory Education

Multisensory teaching methods within the reading curriculum introduce alphabetic patterns and words using various learning modalities. Coffield, Moseley, Hall and Ecclestone (2004) conducted a comprehensive review of different learning style teaching methods to determine the most effective approaches and their implications on teaching and learning. They explored the different sensory modalities involved in learning and concluded that the primary modalities included the visual, auditory, and kinesthetic-tactile (VAKT) senses. Multisensory methods 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. "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?''' (Matt 14: 30, 31). Jesus used that experience as an illustration of the power He gives His children to rise above their circumstances (i.e., 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 what a godly life would look like.

Within the academic context, the development of multisensory instruction is most notably attributed to Samuel Orton, a neurologist, during the twentieth century (Dahl, 2011). 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, even though 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 due to the person's inability to access the left hemisphere of the brain when reading (Dahl, 2011). He believed this was due to a lack of hemispheric dominance, or left brain vs. right brain functions (Sutherland & Smith, 1991; Dahl, 2011; Orton, 1925). 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 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 that instruction could be disseminated through 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 need to meet the academic needs of the low-achieving learners without sacrificing core reading content (Woodward & Talbert-Johnson, 2009). The use of multisensory structured language instruction was developed for the purpose of meeting these students' needs (International Dyslexia Association [IDA], 2009). Therefore, the purpose of this study is 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 are 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 a multisensory component taught by the researcher with additional classroom teacher reinforcement. These students will be evaluated using a combination of researcher-created and professionally developed pretests and posttests to examine differences in achievement between the two groups in decoding abilities, which will be measured by word attack (nonsense words) and word identification (real words) subtests, as well as encoding abilities and oral reading

fluency. The word identification subtest will measure the number of words read correctly within a one-minute time frame (Good & Kaminski, 2002). The word attack subtest will measure the total phonemes (sounds) within each word that were pronounced correctly until the student reaches a ceiling by incorrectly decoding five consecutive words (Woodcock, 2011; Brigance, 1999). The encoding subtest will measure correct letter-sound association (called "phonics points" on the subtest) and correct spelling of words (Bear, Invernizzi, Templeton, & Johnston, 2008). The oral reading fluency will be assessed by averaging the number of correct words read within three connected word passages during a one-minute time sample (Good & Kaminski, 2002).

Statement of Research Questions

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

1. Does supplemental multisensory instruction improve overall student performance in decoding, encoding and oral reading fluency abilities 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 abilities of first-grade students in the bottom 50^{th} 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 abilities of first-grade students in the top 50^{th} 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: 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 all first-grade students receiving classroom reading instruction only (control group) and first-grade students receiving classroom instruction supplemented with a multisensory component taught by the researcher and reinforced by the classroom teacher (treatment group).

Ho2: 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 all first-grade students receiving classroom reading instruction only (control group) and first-grade students receiving classroom instruction supplemented with a multisensory component taught by the researcher and reinforced by the classroom teacher (treatment group).

Ho3: 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 a multisensory component taught by the researcher and reinforced by the classroom teacher (treatment group).

Ho4: There is no significant difference in the improvement scores of phonics points 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 a multisensory component taught by the researcher and reinforced by the classroom teacher (treatment group).

Ho5: There is no significant difference in the improvement scores on the DIBELS Oral Reading Fluency 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 a multisensory component 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 a multisensory component 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 a multisensory component 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 and first-grade students receiving classroom instruction supplemented with a multisensory component taught by the researcher and reinforced by the classroom teacher.

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 and first-grade students receiving classroom instruction supplemented with a multisensory component taught by the researcher and reinforced by the classroom teacher.

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 a multisensory component 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 a multisensory component 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 a multisensory component 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 and first-grade students receiving classroom instruction supplemented with a multisensory component taught by the researcher and reinforced by the classroom teacher.

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 and first-grade students receiving classroom instruction supplemented with a multisensory component taught by the researcher and reinforced by the classroom teacher instruction supplemented with a multisensory component taught by the researcher and reinforced by the classroom teacher.

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 of DIBELS Oral Reading Fluency subtest, as measured by the pretest and posttest, between those first-grade students receiving classroom reading instruction only and first-grade students receiving classroom instruction supplemented with a multisensory component taught by the researcher and reinforced by the classroom teacher instruction supplemented with a multisensory component taught by the researcher and reinforced by the classroom teacher.

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 accepts the following assumptions:

1. The provision of systematic, explicit phonics instruction related to basal readers improves decoding skills in connected text.
2. Confidentiality of individual student scores and records will be protected throughout the study.
3. First-grade students involved in this study reflect the general population of first-grade students within Christian schools appropriate to age and cognitive levels.
4. The students will appropriately demonstrate 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 includes 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 will be limited to approximately half of the time requested by researcher.
2. The research design is using 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 is causing a reduction in some of the phonics skills that are able to be reinforced with multisensory methods.

Definition of Terms

1. *Basal readers*: grade-leveled series of textbooks that surround the stories around 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 which 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 Dr. 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 (The Learning Point [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 will be measured by a student's oral reading rate and accuracy. Due to the fact that reading *expression* is somewhat subjective and difficult to measure, it will not be included as a factor in evaluating the students' oral reading fluency skills.
15. *Real words*: for the purpose of this study, real words are defined as words with commonly-understood meaning. These words will be 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 (i.e. subject-verb agreement). 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 will then be 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, may increase their encoding, decoding, and oral reading fluency rate by supplementing traditional classroom reading curriculum with the introduction of multisensory materials and methods being used systematically and consistently along with the classroom curriculum. This study will also evaluate the extent to which average and above average readers, relative to their peers, improve in their reading abilities due to supplemental multisensory instruction in relation to readers without the intervention. Therefore, the goal of this study is to evaluate whether a multisensory supplement to the existing reading curriculum better supports the different learning styles 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 will examine the literature related to the study. Descriptive information related to components of reading acquisition and factors contributing to children's reading difficulties are explored in depth before the focus of multisensory instruction is discussed. This is 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 II

A REVIEW OF THE LITERATURE

In order to present the case for systematic classroom multisensory reading instruction, a review of the literature explaining and examining factors that contribute 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 a systematic, consistently applied multisensory component added to the reading curriculum will make any difference in the child's reading abilities.

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 phonemic awareness, syntax, semantics, and vocabulary, 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). Researchers and educators have sought a variety of methods to help make this transition to an understanding of printed text more comprehensible (NRP, 2000; Fuchs et al, 2012; Miller-Shaul, 2005).

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 contributing factor to 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 poor 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 these words don't 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, fifty to sixty percent of reading disabilities have some type of genetic linkage (Vellutino, 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 & DeFries, 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 *composition* and *function* 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 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 strangles. This loop between the occipital lobe, Broca's area in the 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).

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 tempoparietal region of the brain, which is the area that aids in correlating written words to spoken words. Since an increase in white matter has been associated with increased reading skills (Klingberg et al., 2000), a decreased amount of white matter lessens the ability of this area of the brain to efficiently communicate with other areas of the brain, potentially reducing the 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). 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 deceased's 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 disability in phonological awareness.

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 with 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.

Not only does the brain *composition* differ between those with and without dyslexia, but multiple brain imaging studies also provide evidence that the brain *function* in these two groups also differs from one another. This evidence was 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 to accomplish the reading tasks. Shaywitz suggested that this may be a contributing factor as to why children with dyslexia often become good decoders and can read grade-level text, but the reading rate is very slow and laborious (Shaywitz et al., 2002).

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.

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 2011 national reading assessment, 69% of ELL's performed below *Basic*, 31% performed at or above *Basic*, 7% at or above *Proficient*, and 1% performed at the *Advanced* level (NCES, 2011). These results are due to the fact that ELL students, as compared to their English-speaking counterparts, have less background knowledge of the 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 effects 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 seventeen schools (4,728 students) did not receive these funds. Thirty-nine percent of the group receiving Title 1 funds) passed the FCAT whereas sixty-five percent of those that did not receive Title 1 funds passed the FCAT. 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, & 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).

Single parent households have an impact on a child's educational achievement in several different ways. First, most single-parent families have less resources in which to aid educational needs given that these families must usually survive on one income (Scott, DeRose, Lippman, & Cook, 2013). Second, most single parents have much less time available to spend with their children, due to the fact that they are carrying the entire load of household and childcare

responsibilities rather than sharing it with another adult (American Psychological Association [APA], 2013). Simply put, these children are much more likely to be left fending for themselves, which has a significantly negative impact on their academic and social development (Barajas, 2011; Entwisle & Alexander, 1996).

Another variable that is often found in low SES families is an increased number of siblings. These larger families, due to increased individual needs, often have less availability of time and economic resources with which to further academic causes. (Downey, 2001; Coleman, 1988; Sirin, 2005). In addition, families that fall into this category oftentimes live in lower income, urban areas with academically weaker schools which have less educational resources available (Pong, 1997). The mother's educational level is another significant influence on the child's reading achievement (DeGarmo, Forgatch, & Martinez, 1999; Vagi, 2007), particularly in low SES homes. Studies show that the mother plays a significant role in providing school readiness skills (such as basic reading and math skills) for her young child and that these skills affect the child's future academic achievement (Brooks-Gunn, Rouse, & McLanahan, 2007; Tracey & Young, 2002).

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, et al., 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 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.

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

The International Reading Association (1998) describes phonemic awareness as the ability of the language learner to manipulate the sounds of oral speech. 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 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). 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).

Many studies have been conducted on the impact of phonemic awareness (PA) on reading acquisition. The National Reading Panel (NRP) 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). 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). The overall effect on spelling was also moderate, (d = 0.59). Interestingly, tests given several months following the intervention revealed statistically significant effects (d =.073). 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; specifically, the acquisition of letters and sounds (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 National Reading Panel (2000), it is the "systematic phonics instruction [which] leads to significant positive benefits for students in kindergarten through sixth grade and for children with difficulty learning to read" (p. 1)

Phonics is a critical component of reading acquisition because it focuses on the ability to decode printed language (Allor, 2002; Anthony et al., 2006). 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). It can be defined as an understanding of 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 from 1979 to 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, a larger vocabulary knowledge equates with increased text comprehension (NRP, 2000).

Fluency

Fluency is defined as the ability to read texts quickly and accurately (National Institute for Literacy [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). As a person becomes more fluent, their attention shifts from decoding individual words to sight reading. This allows the reader to focus mental effort on the message of the text rather than the sounding out of

words. 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 statististically 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). The NRP 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 students' 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 (van der Lely & Marshall, 2010; 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 effect 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 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 (2003), of all these strategies, the 'question generation' strategy produced the strongest scientific evidence although teaching a combination of these reading comprehension strategies is considered the most effective.

Conclusion

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 these skills combine together to create the reading experience and are the essential components of skilled reading.

Explanation of Multisensory Instruction

Definition and Description of Multisensory 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). The IDA 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" (Moats, L., et al., 2010, 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.

The theory behind multisensory instruction is that 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 of 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. (Turan & Gozde, 2008).

Multisensory instruction teaches each component of language 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. These elements of language instruction are taught bi-directionally with a focus on encoding (sound-to-letter correspondence) and decoding (letter-to-sound correspondence) relationships. Reading fluency and comprehension skills are increasingly integrated as the student demonstrates an understanding of letter-sound relationships (IMSLEC, 2013; Wilson, 1989; IDA, 2009).

Features of Multisensory Instruction

The distinguishing features of a multisensory instructional approach are its content (what is taught) and its principles of instruction (how it is taught) (IMSLEC, 2013)). The content consists of phonology, sound-symbol association, syllable instruction, morphology, syntax, and semantics. The principles of instruction 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 International Multisensory Structured Language Education Council (IMSLEC) summarizes the features of multisensory instruction:

Content of Multisensory Instruction

- *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 (letter) to grapheme (sound) 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 senses. This means that as the letter is displayed (visual), the student must produce the corresponding letter (auditory), and as the letter sound is given (auditory), the student must write, or point to, the appropriate letter (visual).

- *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, sentences 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 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 Impact of Phonics and Multisensory Instruction for Struggling Readers

When children's reading and overall achievement scores improve with the introduction of multisensory instruction used in conjunction with systematic, structured phonics instruction, the question can easily be raised as to whether it is the phonics instruction, the multisensory component, or a combination of both, that produces the desired result of improved reading skills. Torgesen et al., (2001a) studied the effects of intensive phonics instruction, without a multisensory component, on students with severe phonological-based reading disabilities as demonstrated by an average student score below the 1st percentile on the pre-intervention word attack subtest. Sixty participants who had received an average of 16 months of special education intervention prior to the study, received one-on-one instruction in two 50-minute segments daily for eight weeks. Prior to the onset of study intervention, the 60 participants were divided into three groups of *low*, *medium*, and *high* according to their phonological processing ability as measured by the *Comprehensive Test of Phonological Processes*. Following treatment, students were assessed in their decoding abilities using the *Woodcock Reading Mastery Test-Revised* subtest of nonsense words. Standard scores from students in the *low* group improved from 70.2 to 93.5. The *middle* group improved 67.4 to 91.6, and the *high* group improved 74.1 to 95.6. Longitudinal data also reported improvement in all students' broad reading abilities showing a progression from the 7th percentile to the 30th percentile at the two-year follow up assessment. This study suggests a strong correlation between reading achievement and systematic instruction in phonics skills.

A dissertation study by Stewart (2011) tested the Orton-Gillingham method of phonics instruction (multisensory, explicit, and systematic) versus an embedded phonics instructional approach (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 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 Word Attack subtest. The difference between the groups was significant and the effect size was large (p = .000; t (49) = 6.25). On the Word Identification 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 when used in conjunction with a systematic phonics instructional approach.

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 had previous reading instruction in *Open Court*, an evidenced-based reading program with a focus on explicit and systematic phonics instruction yet 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 instructed these students in an additional 20 lessons using *Practice Court (PC)*, an explicit and systematic reading program with a focus in phonics, 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).

A collective reading of the previous three studies suggests that systematic and explicit phonics instruction makes large inroads into improving student reading achievement. It also suggests that integrating multisensory methods when teaching the phonetic concepts further improves student outcomes. The last study, however, theorizes that multisensory instruction may not work to improve the reading abilities of those students who have not responded to other types of reading improvement treatment, even when the multisensory methods are combined with systematic phonics instruction.

Multisensory Instruction for Average Readers

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, there are a few studies that include the impact of this form of instruction on average readers. Scheffel, Shaw, and Shaw (2008) sought to evaluate the

effectiveness of an Orton-Gillingham multisensory instruction within three different schools. . The participants were a total of 702 first-grade students. The treatment group consisted of 226 students and the control group included 476 students. Both treatment and control groups contained a mix of *low* and *average* readers within this study. According to the authors the purpose of this study "was not to separate and examine individual components of the (IMSE [Institute for Multi-Sensory Education]) supplemental reading program," rather, it was to "study the effectiveness of this program in a real-world setting in which the teachers in the treatment group implemented this program and the comparison group teachers did not" (p. 4). Both groups received 90 minutes daily of traditional reading instruction using the district's approved curriculum. The treatment group received 30 minutes daily of supplementary 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 their achievement in both groups in the areas of phonemic awareness and the alphabetic principle measured by the phonemic segmentation fluency (PSF) subtest, the nonsense words fluency subtest (NWF), and the oral reading fluency (ORF).

Those students at greatest risk for reading failure within the treatment group (bottom twenty-fifth percentile) measured the greatest improvement in phonemic awareness skills as measured by the phonemic segmentation fluency (PSF) subtest. The at-risk students in the treatment group scored above the DIBELS benchmark from winter to spring assessments. The control group scored below the DIBELS benchmark. From the fall to winter assessments, the treatment group transitioned 25% and the comparison group transitioned 20% of 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 5th percentile were 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 Nonsense Words Fluency (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, D.L., Shaw, J.C., and Shaw, R., 2008).

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. During this 120-minute block, the treatment group spent a specified time on OG instruction. 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 to the same set of 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 were looking at the words (visual), while they were listening to them (auditory), and they were moving their finger across the word(s) as they were spoken (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).

Commercial Orton-Gillingham Approaches

There are a number of multisensory programs that base their instruction on the Orton-Gillingham approach. The International Dyslexia Association developed a Matrix of Multisensory Language Programs in order to help the consumer sift through the different instructional variations within each program. Among the most popular programs are Alphabetic Phonics, The Herman Method, Lindamood-Bell, Orton-Gillingham, Project Read, Slingerland,

Spalding Method, and the Wilson Reading System (McIntyre & Pickering, 2001). Each of these programs includes systematic and explicit phonics instruction using the auditory and visual learning modalities for sounds and tactile-kinesthetic feedback for letter formation (Alexander & Slinger-Constant, 2004). However, the specific content varies from program to program.

Wilson Reading System

The current study uses instructional methods from the Wilson Reading System (WRS) program, which implements multisensory instruction to teach the alphabetic principle and help students develop phonological awareness. This 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 is one of the original multisensory methods that many commercial multisensory programs, such as the Wilson Reading System (WRS), are based upon. Her training and work experience led her to develop the WRS method, which 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 using 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 method 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 the 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:

6. *Quick drill (in reverse)*- teacher gives the sound and student identifies corresponding letter(s) using color-coded cards or tiles.
7. *Teach and review concepts for spelling*- student applies tapping procedure to spelling of words and visually represents words using sound cards
8. *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:

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

(Wilson, 1989)

Encoding and Decoding Instruction

Research on the use of encoding and decoding 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 across 22 schools 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 20th 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 90 minutes of daily language arts instruction. In addition to this, students involved in the study 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 fidelity of the implementation. 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 consider 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. In this particular sample, more variance in student scores were explained and predicted by the amount of classroom encoding instruction.

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 Language Series) with a focus on encoding and decoding instruction would result in significant 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, 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 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* tests 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 the 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.

Blachman et al. (2004) conducted a study examining the interaction between encoding and decoding activities in helping students connect letters to sounds. One hundred twenty-six second and third graders in the bottom 25th percentile of word identification skills received one-on-one daily tutoring in fifty-minute segments over a period of 8 months. Instruction included 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 the school's prescribed core classroom reading instruction related reading resource instruction. Posttest assessments evaluated real and nonsense word reading, reading rate, passage reading, and spelling. These assessments revealed significant improvement in word reading, 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 students' decoding and encoding abilities. These studies provide clear evidence that the use of multisensory encoding and decoding instruction within a phonics-based program has a significantly positive effect on the performance of struggling students in reading and spelling.

Conclusion

The theory and implementation of multisensory instruction has been discussed for decades. This method 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 real word identification and nonsense word attack subtests, encoding (spelling ability and phonics points), and oral reading fluency skills. The sample population includes four intact classrooms- two that will receive the intervention teaching methods and two that will not. This chapter presents a restatement of the problem being studied, along with a restatement of the research questions and null hypotheses. It also includes a description of the research design, the sample population, test instrument measurements and data treatment from those tests, as well as how the data from those tests is to be analyzed. The chapter concludes with a summary of the pilot study.

Restatement of the Problem

The purpose of this study is 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 are affected depending upon one of two treatments of classroom instruction received: (1) classroom reading program with no supplemental multisensory instruction or reinforcement, (2) classroom reading program supplemented with a multisensory component taught by the researcher with additional classroom teacher reinforcement. These students will be evaluated using a combination of researcher-created and professionally developed pretests and posttests to

examine differences in achievement between the two groups in decoding abilities, which will be measured by word attack (nonsense words) and word identification (real words) subtests, as well as encoding abilities and oral reading fluency.

Restatement of Research Questions

This study attempts to answer the following questions related to the addition of supplemental multisensory instruction aligned with the classroom 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 abilities of first-grade students in the bottom 50^{th} percentile of total reading scores, relative to their peers, on the Stanford Achievement Test within the first grade as measured by a pretest and posttest?
3. Does supplemental multisensory instruction improve performance in decoding, encoding and oral reading fluency abilities of first-grade students in the top 50^{th} percentile of total reading scores on the Stanford Achievement Test within the BJA first grade as measured by a pretest and posttest?

Restated Null Hypotheses

Ho1: 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 all first-grade students receiving classroom reading instruction only (control group) and first-grade students

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

Ho2: 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 all first-grade students receiving classroom reading instruction only (control group) and first-grade students receiving classroom instruction supplemented with a multisensory component taught by the researcher and reinforced by the classroom teacher (treatment group).

Ho3: 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 a multisensory component taught by the researcher and reinforced by the classroom teacher (treatment group).

Ho4: There is no significant difference in the improvement scores of phonics points 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 a multisensory component taught by the researcher and reinforced by the classroom teacher (treatment group).

Ho5: There is no significant difference in the improvement scores on the DIBELS Oral Reading Fluency 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 a multisensory component 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 a multisensory component 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 a multisensory component 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 and first-grade students receiving classroom instruction supplemented with a multisensory component taught by the researcher and reinforced by the classroom teacher.

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 and first-grade students receiving classroom instruction supplemented with a multisensory component taught by the researcher and reinforced by the classroom teacher.

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 a multisensory component 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 a multisensory component 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 a multisensory component 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 and first-grade students receiving classroom instruction supplemented with a multisensory component taught by the researcher and reinforced by the classroom teacher.

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 and first-grade students receiving classroom instruction supplemented with a multisensory component taught by the researcher and reinforced by the classroom teacher instruction supplemented with a multisensory component taught by the researcher and reinforced by the classroom teacher.

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 of DIBELS Oral Reading Fluency subtest, as measured by the pretest and posttest, between those first-grade students receiving classroom reading instruction only and first-grade students receiving classroom instruction supplemented with a multisensory component taught by the researcher and reinforced by the classroom teacher

instruction supplemented with a multisensory component taught by the researcher and reinforced by the classroom teacher.

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 a 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 on 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 that would be used in the classrooms and 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 into 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 treatment classes were chosen based on teacher-expressed interest in the integration of supplemental multisensory methods within the existing curriculum. The other two first grade classes make 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 is to examine the development of learning as a result of the experimental instructional intervention in relation to students without the experimental intervention. All students begin with some level of background knowledge. The purpose of this study is to determine the extent of progress from that initial knowledge base that is related to the 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 will be given four separate pretests and four separate posttests. The pretests include two decoding subtests, one that assesses word identification and fluency using real words (*word identification* subtest), and one that assesses the ability to connect letter(s) with sounds by decoding nonsense words (*word attack* subtest); an encoding subtest that is measured in two parts: phonics points and words spelled correctly, and a subtest that assesses oral reading fluency (the DORF subtest). The posttests will cover the three same areas of study—decoding, encoding and oral reading fluency—and will include the same types of tests but the tests themselves will be variations from the pretest in order to eliminate recognition of the words from the pretest.

This study includes one treatment group and one control group. The treatment group consists of two classes of first-grade students from Bob Jones Academy (BJA) and the control group consists of the other two classes of first-grade students. The two classes within the control group will receive daily instruction from the BJ reading curriculum without any additional multisensory supplemental instruction. The two classes within the treatment group will also be receiving daily instruction from the Bob Jones (BJ) reading curriculum that the researcher will then supplement with multisensory methods for 15-20 minutes, three times a week for 12 weeks. The classroom teachers in the treatment group will also reinforce the multisensory methods introduced by the researcher by using an implementation checklist with specific instructions as to

methods and time frames for this reinforcement (see Appendix C). All four classroom teachers will be covering the phonics skills in the order and within the time frame prescribed within the BJ reading curriculum scope and sequence. This will ensure that all four classes (treatment and control) are being taught the same lesson from the BJ reading curriculum on the same day.

The researcher's intervention involves supplementing the teaching of the phonics-curriculum concepts from the scope and sequence by using multisensory encoding and decoding instruction that includes a kinesthetic-tactile component. Decoding instruction consists 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 teacher will reinforce those methods that focus on both decoding and encoding and will include methods with a kinesthetic-tactile component as well by following the implementation checklist mentioned above (see Appendix C). The decoding reinforcement activities will include working on individual grapheme-phoneme (letter-sound) correspondences through a daily drill of letters, their associated keywords, and the sounds they make. Encoding will be 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 detailed description of the multisensory methods that will be 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 will be kept confidential by assigning each student a code number that will be unknown to the researcher. Records will be divided by class, and by upper and lower 50th reading percentile within each class. 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 will not administer or score these tests in order to eliminate research bias. Inter-rater reliability of these individually administered tests will be established through the pilot study. The encoding subtest will be administered by the classroom teachers and directions will be given following a scripted format. Because the actual scoring of the encoding subtest requires advanced knowledge of phonics concepts that will be taught during the study, the researcher will score each test. However, prior to scoring, a separate evaluator will remove personal information from each individual test (ie. student names) and assign a code number that will be unknown to the researcher. The separate evaluator will also keep a list as to which class (treatment or control) each test came from and those codes within each class that fall in the top 50th reading percentile and the bottom 50th reading percentile. After all tests are scored, the separate evaluator will group each code number with its associated test score according to treatment or control group, and within those groups, according to which percentile (bottom 50th or top 50th on the Stanford Achievement Score) the code number belongs, for the researcher to analyze the data. This process will help 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 Phonics and Reading Program

The Bob Jones 1st 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 will follow 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 will be 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 of skills directly relates to the basal readers in the BJ core classroom curriculum, as opposed to the Wilson method, which teaches these skills in a different order. The goal is to help

the students establish a better connection between sound and print through explicit and systematic multisensory instruction aligned with the classroom basal reading curriculum. It is explicit in that student attention is focused on specific learning outcomes within a structured environment. It is systematic in that skills are taught sequentially with each new concept building upon previously learned material. Each of the researcher's lessons will include one or more elements from the decoding sections and one or more elements from the encoding section and will be taught for the time frames listed beside the methods below.

The decoding section will consist of five elements:

1. *Letter name and sound recognition (one minute).* Students will give the name/keyword/ sound for each color-coded sound card that is shown. These sounds will be introduced in the same order as those in the BJ Phonics curriculum. Two formats for this skill instruction will be used. First, students will go through a quick drill of the sound cards in the beginning of each lesson. Second, the researcher will recite a letter(s) name to the students. They will repeat the name and pull out the corresponding letter(s) tile(s) from their magnetic letter boards.

2. *Blending sounds to form words (two minutes).* In initial lessons, students segment sounds within a word using a finger-tapping procedure. The researcher will use sound cards to spell a word on the dry-erase board that contains phonics skills from current and previous lessons. Students will practice 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 will go through a quick drill each day in order to apply knowledge of phonics rules to the reading

of words, they will do a variety of other activities related to analyzing word structure using word cards.

The encoding section consists of three elements:

1. *Letter name and sound recognition (in reverse) (two minutes)*- The researcher gives the sound and students identify 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 will dictate three to five words (real or nonsense), containing phonics skills from current and previous lessons to the students. The students will repeat the word, tap out the sounds within that word, and pull out the corresponding letter tiles.

3. *Written work (five to ten minutes)*- This aspect of encoding instruction will be taught in two formats. First, the researcher will dictate three to five sounds that correspond to the phonics rules taught during the study, which focuses the instruction on letter-sound association. Students will repeat the sound and write the letters for these sounds. Second, the researcher will dictate to the students three to five words containing phonics skills from current and previous lessons in order to analyze word structure. The students will repeat the word, tap out the sound within that word, and write 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 is divided into three categories: decoding, encoding, and oral reading fluency. The pretests and posttests are alternate forms 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 will be used for two purposes. First, it is used to determine a baseline level of knowledge for each child's decoding, encoding, and oral reading fluency skills. This information will be used to calculate the level of improvement that is gained in a posttest score comparison. Second, it is 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 is to provide a more precise assessment of student mastery of the specific classroom curriculum phonics skills that will be taught during the study. Words are placed in order according to when they were covered in the study. Therefore, the first few words on the test contain phonics rules that will be covered in the beginning of the study. Likewise, the last few words contained phonics rules that will be covered at the end of the study.

Word identification subtest. The word identification subtest involves the student's timed ability to decode isolated, commonly understood (real) words (see Appendix E). Measurement of a student's isolated word knowledge can be 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 prediction for second graders' oral reading abilities ($p < .05$). In the present study, the researcher-created word identification subtest contains words with the phonics skills that will be taught progressively throughout the study.

Evaluation of word identification subtest responses. Students will be evaluated by the number of complete words read correctly within a one-minute time sample. If the student hesitates more than 3 seconds, the evaluator will score the word as incorrect and instruct the student to read the next word.

Word attack (nonsense word) subtest. The word attack subtest measures the student's ability to decode nonsense words (see Appendix E). The word attack subtest is a critically important method of testing decoding ability because it 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 student is completely unfamiliar with these words, they cannot 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 will be similar in format to the Dynamic Indicators of Basic Early Literacy (DIBELS) Nonsense Word Fluency 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 will be presented with a list of nonsense words containing phonics rules that for the pretest, have not yet been taught but will be during the course of the study, and, for the posttest, have been taught during the study. The students will be asked to verbally produce the individual letter sound (or letter clusters) or read the entire nonsense word. For example, if the student is 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 is color-coded according to the number of phonemes in that particular word (see Appendix D). Scores are based on whether the student correctly sounded out each phoneme in that word; and thus, partial creditcan also be awarded for each word. Similar to the previous example of the nonsense word "lin," if the student pronounces it as /l/ /i/ /m/, then the student only receives credit for identifying the /l/ and /i/ sounds and receives a score of 2/3. After one-minute, the evaluator will place a line under the last word read within that time sample, but each student will read until either the whole list has been read or a ceiling of five consecutive wrong answers (measured by incorrect reading of the nonsense word) is reached, whichever comes first. This enables the researcher to evaluate the timed reading of nonsense words and measure the level of decoding ability according to the phonics skills that are covered within this list. 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 are ignored. Hesitations of more than three seconds are scored as incorrect. The

total amount of phonemes in each word for the entire test will be tabulated and student scores will reflect 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. Everyone 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 is supplementing and the classroom teachers are reinforcing phonics concepts that are already being taught with the current curriculum, the words on these decoding assessments contain the same phonics rules that are 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,

> 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 who are viewed highly for their standards in a particular content area (p. 1).

The panel has compared each word in these decoding subtests with the BJ Reading curriculum scope and sequence to confirm that the assessments will cover those skills taught during the study. Consistency of measurement reliability for all subtests will be established through its administration to ten first-grade students. A separate split-halves method will be

conducted on both alternate forms and compared to determine content reliability of both tests. Data analyses will be conducted using SPSS software, and Spearman Brown Coefficient will be 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 will be that real words will be used for the researcher-created encoding subtest, and they will only contain phonics rules taught during the study. Each encoding test will be administered by the classroom teachers. Student response sheets will be collected by an alternate evaluator and assigned a code number that is unknown to the researcher to prevent possible bias during researcher-scoring of student results. Similar to the word identification and word attack subtests, encoding pretest and posttest will be 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) that will evaluate students' abilities to spell each word correctly and their knowledge of word patterns that are taught during the study.

In the same way as the Words their Way evaluation form, the researcher-created evaluation form assesses student understanding of phoneme-grapheme relationships using invented and developmental spelling knowledge. It does so by separating each word into its individual phonemic components. These phonemic components, which correspond with the phonics and spelling skills that are to be taught during the study, are placed on a grid across the top of the form. Evaluation will consist of the following letter- sound association skills and 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 are separated into two separate components on this test. The first component consists of words that are spelled correctly. The second component consists of the individual phonemic elements within each word (called "phonics points" on the subtest). Students may be given credit for applying the correct phonics rule to the word even if the word is spelled incorrectly. For example, the word "fight" contains three separate phonemic components: /f/, /ī/, /t/. The student can receive full phonics points credit for spelling this word as "fight" or "fite" because correct phonics rules are being 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 are those that will be taught during the study. The encoding subtest pretest and posttest will be administered by the classroom teachers. Directions will be 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 requires advanced knowledge of phonics concepts that will be taught during the study, the researcher will score each test.

Prior to scoring, a separate evaluator will remove personal information (i.e., student names) from each individual test and assigned a code number that will be unknown to the researcher. The separate evaluator will keep 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 will not know whether the test came from the treatment group or the control group. After all tests are scored and prior to data analysis by the researcher, the separate evaluator will group each code number with its associated test score according to treatment or control group, and within those groups, whether each student was in the bottom 50^{th} or the top 50^{th} percentile relative to their peers on the Stanford Achievement Reading Test.. This process helps to eliminate any research bias. Consistency of measurement reliability for the subtest will

be established through its administration to ten first-grade students. Separate split-halves method will be conducted on both pretest and the alternate-form posttest and compared to determine reliability of both tests. Data analyses will be conducted using SPSS software, and Spearman Brown Correlation Coefficient will be used to determine the correlation coefficient.

Oral Reading Fluency Subtest. The third category of evaluation involves 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 will be a variation on the pretest reading sample, testing the same phonics skills that have been covered during the study.

Evaluation of the oral reading fluency subtest assessment. Students will be 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 will measure how well a student reads aloud a passage for a one-minute period. All omissions, substitutions, and hesitations of more than three seconds will be considered errors. Self-corrections within three seconds are considered accurate. The oral reading rate is the number of words read correctly from the passage in one-minute. Each student will read three passages. Each passage will be read for one-minute and scored separately. The average of the three scores will be taken as 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 skills rather than the short-term objectives 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 will be conducted during the spring of the 2013-2014 school year, following the intervention study in the classrooms. Pretest and posttest assessments for the encoding will be scored by the researcher, while pretest and posttest assessments for the decoding word identification, word attack, and oral reading fluency subtests will be scored by two separate evaluators. Student scores on the Word Identification subtest will be calculated by the total number of words read within a one-minute time sample. Student scores on the encoding skills subtest components, "words spelled correctly" and "phonics points*"* will be calculated using the evaluation guide established by the researcher (see Appendix F). Student scores on the DORF will be calculated by the answer key established by the instrument. The data will be

entered into the Statistical Package for the Social Sciences (SPSS) statistical software. Parametric statistical procedures will be used to analyze data and test the null hypotheses.

Content validity for the word attack, word identification, and encoding researcher-created subtests, was created using the Spearman Brown Coefficient. An Independent 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 word identification, word attack, encoding, and oral reading fluency evaluations.

Pilot Study

A pilot study has been performed 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: word identification, 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: word identification, 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 .875 for the pretest and .950 for the posttest indicating strong content reliability (see Appendix G). The data analysis for the 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 .845 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: word identification, 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 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 word identification subtest indicated that there was no significant difference in the constructed mean scores for the two groups: treatment and control (see Appendix O). However, the equality of means approached significance at 0.58. The null hypothesis stating there was no significant difference between the treatment and control group in decoding word identification skills was accepted. The word attack subtest yielded a .0140 (see Appendix P). Therefore, the null hypothesis stating there was no significant difference between

the treatment and control group in decoding word attack 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 0.18 and the phonics points' component yielded 0.158 (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 (see yielded a 0.139 indicating there was no significant difference between the two groups (see Appendix R). The null hypothesis stating there was no significant difference between the two groups in oral reading fluency skills was accepted. All statistical analyses 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. 654) the following values were used to establish sample size for this dissertation study:

- The level of significance (α)= .05
- The power of the test = .80 (4:1 ratio of β to α; β = .20)
- The standardized effect size= 1.0 σ^2
- Treatment levels (k)= 3

The appropriate sample size for this study would be a minimum of 20 students.

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LIST OF APPENDICES?

Appendix A

Dissertation Study Plan

Dissertation Study Plan

Classroom Implementation

- 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: Encoding and Decoding
  - 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 students' 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 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 (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 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

Implementation Checklist

for Classroom Teachers

Monday	Drill sounds (1 min.) _____	Tap out sounds in words (decoding) (2 min.) _____	Spelling Words using magnetic letter boards (encoding) (5 min.) _____
Tuesday	Drill Sounds (1 min.) _____	Tap out sounds in words (decoding) (2 min.) _____	
Wednesday	Drill Sounds (1 min.) _____	Tap out sounds in words (decoding) (2 min.) _____	Encoding Checkup (7 min.) _____
Thursday	Drill Sounds (1 min.) _____	Tap out sounds in words (decoding) (2 min.) _____	
Friday	Drill Sounds (1 min.) _____	Tap out sounds in words (decoding) (2 min.) _____	

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 Forms

Pretest Word Attack Evaluator Form

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

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

Appendix F

Encoding

Pretest and Posttest Evaluator Forms

Encoding Pretest Evaluator Form, page 1

Above / Below 50th				Words Spelled Correctly:			Phonics Points:		/186	Total:	/246		Treatment		Control	
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														
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	
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. mole	m	l	o				o-e (oa)								/4	
28. bite	b			t			i-e								/4	
29. laid	l	d					ai (a-e)								/3	
30. seed	s	d					ee (ea/e-e)								/3	
Total	/19	/13	/21	/14	/8	/6	/4	---	/3	/9	/3	---	---	---	/101	/30

Encoding Pretest Evaluator Form, page 2

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														
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 (ou)							/3	
35. clown				gl				ow (ou)							/2	
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	
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							/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	/14	/4	/7	---	---	/6	/14	---	---	---	/4	/6	/4	/85	/30
Grand Total	/45	/27	/25	/21	/8	/6	/10	/14	/3	/9	/3	/4	/6	/4	/186	/60

Encoding Post Test Evaluator Form, page 1

Above / Below 50th				Words Spelled Correctly: /60			Phonics Points: /186			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
1. slip		p	i	sl											/2	
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	
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)								/4	
28. bite	b	t					i-e (igh)								/4	
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	---	---	---	/100	/30

Encoding Post Test Evaluator Form, page 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
31. flight		t		fl			igh (i-e)								/3	
32. tie	t						ie (i)								/2	
33. hound	h			nd				ou							/3	
34. down	d	n						ow							/3	
35. clown		n		cl				ow							/3	
36. pout	p	t						ou							/3	
37. glow				gl				ow (oe)							/2	
38. toil	t	l						oi							/3	
39. boy	b							oy							/2	
40. moist	m			st				oi							/3	
41. toy	t							oy							/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	
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. loon	l	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	/186	/60

Appendix G

Word Identification

Pretest and Posttest

Split-Halves Reliability Test

Word Identification Pretest

Case Processing Summary

		N	%
Cases	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

Item Statistics

	Mean	Std. Deviation	N
odd	5.8000	2.04396	10
even	5.8000	2.34758	10

Inter-Item Correlation Matrix

	odd	even
odd	1.000	.709
even	.709	1.000

Summary Item Statistics

		Mean	Minimum	Variance	N of Items	Maximum	Range	Maximum / Minimum
Inter-Item Correlations	Part 1	.000	1.798E+308	.000	1[a (odd)]			
	Part 2	.000	1.798E+308	.000	1[b (even)]			
	Both Parts	.709	.709	.000	2	.709	.000	1.000

Word Identification Posttest

Case Processing Summary

		N	%
Cases	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		.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

Summary Item Statistics

		Mean	Minimum	Variance	N of Items	Maximum	Range	Maximum / Minimum
Inter-Item Correlations	Part 1	.000	1.798E+308	.000	1[a (odd)]			
	Part 2	.000	1.798E+308	.000	1[b (even)]			
	Both Parts	.905	.905	.000	2	.905	.000	1.000

Appendix H

Word Attack

Pretest and Posttest

Split-Halves Reliability Test

Word Attack Pretest

Case Processing Summary

		N	%
Cases	Valid	10	100.0
	Excluded[a]	0	.0
	Total	10	100.0

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

Reliability Statistics

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

Inter-Item Correlation Matrix

	odd	even
odd	1.000	.790
even	.790	1.000

Summary Item Statistics

		Mean	Minimum	Variance	N of Items	Maximum	Range	Maximum / Minimum
Inter-Item Correlations	Part 1	.000	1.798E+308	.000	1[a (odd)]			
	Part 2	.000	1.798E+308	.000	1[b (even)]			
	Both Parts	.790	.790	.000	2	.790	.000	1.000

Word Attack Posttest

Case Processing Summary

		N	%
Cases	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		.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

Summary Item Statistics

		Mean	Minimum	Variance	N of Items	Maximum	Range	Maximum / Minimum
Inter-Item Correlations	Part 1	.000	1.798E+308	.000	1[a (odd)]			
	Part 2	.000	1.798E+308	.000	1[b (even)]			
	Both Parts	.731	.731	.000	2	.731	.000	1.000

Appendix I

Encoding

Pretest and Posttest

Split-Halves Reliability Test

Encoding Pretest

Case Processing Summary

		N	%
Cases	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		.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

Summary Item Statistics

		Mean	Minimum	Variance	N of Items	Maximum	Range	Maximum / Minimum
Inter-Item Correlations	Part 1	.000	1.798E+308	.000	1[a (odd)]			
	Part 2	.000	1.798E+308	.000	1[b (even)]			
	Both Parts	.745	.745	.000	2	.745	.000	1.000

Encoding Posttest

Case Processing Summary

		N	%
Cases	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		.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

Summary Item Statistics

		Mean	Minimum	Variance	N of Items	Maximum	Range	Maximum / Minimum
Inter-Item Correlations	Part 1	.000	1.798E+308	.000	1[a (odd)]			
	Part 2	.000	1.798E+308	.000	1[b (even)]			
	Both Parts	.603	.603	.000	2	.603	.000	1.000

Appendix J

Word Identification Pretest and Posttest

Inter-Rater Reliability

Word Identification Pretest

Case Processing Summary

		N	%
Cases	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
.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
Single 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.

Word Identification Posttest

Case Processing Summary

		N	%
Cases	Valid	10	90.9
	Excluded[a]	1	9.1
	Total	11	100.0

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
Single 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

Word Attack Pretest and Posttest

Inter-Rater Reliability

Word Attack Pretest

Case Processing Summary

		N	%
Cases	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
Single 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.

Word Attack Posttest

Case Processing Summary

		N	%
Cases	Valid	10	90.9
	Excluded[a]	1	9.1
	Total	11	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
Single 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 Reliability

Oral Reading Fluency Pretest

Case Processing Summary

		N	%
Cases	Valid	10	71.4
	Excluded[a]	4	28.6
	Total	14	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
Single 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	%
Cases	Valid	10	71.4
	Excluded[a]	4	28.6
	Total	14	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
Single 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

Script for Encoding Test

"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.

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"- An 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 belongings 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 compared to the city that we came from. - “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 has a lot of protein in it and is good for you. - “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 do hair check at school to make sure there are no lice in anyone’s hair. - “lice”
44. “huge”- That is a huge elephant. - “huge”
45. “pace”- We ran a slow pace so that the others could keep up with us. - “pace”
46. “turn”- Everyone needs to listen because it is Macy’s turn to talk. - “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. - “walk”
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. “handle” - Turn the door handle to open it. - “handle”
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” – One of the objectives in baseball is hitting the ball. – “hitting”
20. “banded” – The army banded together and marched forward. – “banded”
21. “blacker” – This yak is blacker then 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 wipe the dust off the furniture. – “duster”
25. “dresses” – Julia has pretty dresses. – “dresses”
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. – “yummy”
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 Administering

and Scoring

Word Attack Subtest

Script for Administering 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 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

Word Identification Subtest

Word Identification Subtest

T-Test

Group Statistics

	Treatment	N	Mean	Std. Deviation	Std. Error Mean
Improvement Score	no treatment	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 Difference	Std. Error Difference	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

Word Attack Subtest

Word Attack Subtest

T-Test

Group Statistics

	Treatment	N	Mean	Std. Deviation	Std. Error Mean
Improvement Score	no treatment	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 Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Improvement Score	Equal variances assumed	.013	.912	--1.637	8	.140	-4.600	2.8110	-11.081	1.881
	Equal variances not assumed			-1.637	7.951	.141	-4.600	2.8110	-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 Scores	no treatment	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 Difference	Std. Error Difference	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 Scores	no treatment	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 Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Improvement Scores	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

Oral Reading Fluency

T-Test

Group Statistics

	Treatment	N	Mean	Std. Deviation	Std. Error Mean
Improvement Score	no treatment	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 Difference	Std. Error Difference	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