FAST FORWARD: AN INVESTIGATION OF THE EFFECTIVENESS OF COMPUTER-ASSISTED READING INTERVENTION

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The three-fold purpose of this quasi-experimental study was to examine the impact of the computer-based reading program Fast ForWord (FFW) on the reading achievement of second-grade students in an Ohio school district. The sample included 360 students (treatment group, \(n=85\); control group, \(n=275\)) from four elementary buildings. FFW is an intervention designed to “build the learning capacity of the brain” (Scientific Learning Corporation, 2010) through individualized games and exercises, and acoustically modified (reduced, then increased) speech. Chall’s Development of Reading (1983) theory supported four research questions that addressed FFW intervention and its effects on students with Individual Education Plans (IEPs) and gender, as measured by the Dynamic Indicator of Basic Early Literacy Skills (DIBELS) and Gates-McGinitie Reading Tests (GMRT) instruments.

Statistical analysis revealed the non-FFW participants demonstrated significantly more growth in reading achievement in nearly every measure. An Analysis of Covariance (ANCOVA), which significantly controlled for pretreatment differences, revealed that FFW participants scored significantly lower on nearly every reading assessment (DIBELS ORF, DIBELS RTF, GMRT Word Decoding, GMRT Word Knowledge, and GMRT Total). A comparison of growth scores for the groups using t-test of independent samples indicated that the non-FFW group showed significantly more growth than the FFW group in DIBELS RTF, GMRT Word Decoding, GMRT Word Knowledge, and GMRT Total. Two-way Analysis of Variance (ANOVA) examined the treatment in relation to the factors of IEP and gender. Results indicated
that FFW participation did not contribute to significant growth in reading achievement in students without an IEP; in addition, FFW did not show promising growth for either gender.

This investigation suggests FFW computer-based intervention was not successful in yielding significant gains in reading achievement as a “one size fits all” intervention. Students receiving traditional teacher-led small group reading instruction demonstrated significantly more growth. The results suggest FFW may be effective for shorter implementation periods or very specific groups of learners, but not in long term global implementation. Schools may find investment in quality professional development for teachers of reading to yield greater gains in student reading achievement.
This dissertation is dedicated to my mother, Patricia Overstake (“Momma O”). Your countless sacrifices and your tireless encouragement to provide your eight ‘dinky darlings’ with an education have made this possible. Happy Mother’s Day, Mom!
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Two photos from my dear friend “Ms. Dianna” Williams sum up my experiences throughout the completion of this journey. The first photograph, a rubber raft with six rafters harnessed in their life vests shooting a rather turbulent white water rapid captures the essence of teamwork. Each appeared to be paddling feverishly in the midst of spraying water and crashing waves to support the group’s goal—completing the rapids. As I ponder that photo clipped to the organizer on my desk, I begin to understand why they are smiling. Like me, their journey has been made more meaningful because of those with me ‘in the raft’. I would like to thank those who have ‘navigated the rapids of this journey’ with me over the past four and a half years.

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Your fervent prayers have availed much (James 5:16). Thank you for standing with me and for me in intercession. I could not have made this ‘loner’ without you!

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The second photograph Ms Dianna sent me was that of a single rafter forging a significant rapid. With the oar tightly clenched and helmet securely fastened, the picture captures the raft just as it begins its descent over the falls. The rafter remains focused yet relaxed, humble yet confident, frightened yet hopeful, and excited yet cautious. “Thank you, Lord, for seeing me through this journey. Although to some it may look as though I completed it alone, but You and I
know better. I cannot begin to count the times and ways You have been exactly what I needed when I needed You. I have learned that I can do all things through Christ who strengthens me. You have been my strength, my shield, my fortress, my friend, my father, my peace, and my comforter. I commit this dissertation and degree to You for Your glory and honor. Amen.”
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CHAPTER I. INTRODUCTION

“Real reading is still the noblest of the arts the medium by which there still come to us the loftiest inspirations, the highest ideals, the purest feeling that have been allowed mankind, —a God-gift indeed, this written word and the power to interpret it.” (Huey, 1908, p. 5)

Background of the Problem

Poking and prying into the secrets of reading performance is not a new phenomenon in American education. For the past century, psychologists and educators have explored the murky waters of quite possibly one of the most complex cognitive tasks known to mankind—the task of reading. Reading has been and continues to be defined and redefined as researchers search for a comprehensive expression of one’s ability to recognize, decode, construct meaning, and respond to the alphabetic symbols in written language. Questions continue to arise as to why some readers manage to acquire this ability quite easily while others are unable to acquire these skills without intense intervention and additional time. Never before have these questions been more provoking than during the current age of educational accountability and standardized testing.

The use of standardized tests to measure student performance and teacher effectiveness began in the United States in 1908 at the request of Elwood Cubberly, dean of Stanford University’s education school (Allington & McGill-Franzen, 2000). Early standardized tests used measurement-driven data to evaluate student potential and performance and to measure the effectiveness of teachers and instructional practices. As the country continued to rely upon standardized tests as ‘the’ measure of academic performance, test results were no longer used at the local level. Educational autonomy began to slip through the fingers of local school districts as state governments were required to report test results to the federal government. The practice of reporting test results to the federal government came as a result of the National Commission on
disparity between the quality of public education being provided to students and the demands for
more rigorous skills and knowledge in response to the changing global needs and competition.
Although the report was not the first report calling for educational reform and accountability, it
was responsible for attaching federal funding to standardized test scores and removing control of
public education from the local school district to the federal government. By the end of the
1990s, the nation began moving toward a standards-based instruction and assessment model.

The enactment of the *No Child Left Behind Act of 2001* (*NCLB*, 2002), the need to
demonstrate Adequate Yearly Progress (AYP) and Value Added (VA), and the dependence upon
standardized test scores to federal funding have left public schools in Ohio searching for more
effective methods of instruction. Relative to the nature of this study is the instruction,
intervention, and progress monitoring of reading performance in the primary grades. School
administrators and instructional leaders are faced with making decisions concerning the selection
of effective and appropriate intervention and instruction. Approaches to intervention can be
grossly defined in four primary constructs: curriculum-based, people-based, computer-based, or
a combination. With limited funding, such decisions are even more important in the adoption and
selection of reading programs to support students’ reading skills. The district in this study was
confronted with such a decision: Which approach to intervention is most effective in
strengthening students’ word recognition, oral reading fluency, and comprehension skills?

**Rationale**

The use of computer-assisted instruction (CAI) is one response to early identification of
children with reading difficulties or at-risk readers. Early identification and intervention is
imperative to the acquisition of reading skills. One hallmark study, in particular, supports early
assessment of reading in school-age children. Juel (1988) conducted a longitudinal study of struggling readers as they progressed from first through fourth grade. The at-risk population contained students of color and low socioeconomic backgrounds. Using Gough’s and Tunmer’s (1986) *Simple View of Reading*, the students’ decoding and comprehension skills were assessed using multiple measures. The selected skills and the grades in which they were administered include the following: phonemic awareness (first-third grade), decoding (first-fourth grade), spelling (first-fourth grade), word recognition (first-fourth grade), listening comprehension (first-fourth grade), comprehension (first-fourth), home reading (first-fourth grade), placement in the classroom basal (first-fourth grade), attitude toward reading (first-fourth grade), IQ (second grade), and writing (first-fourth grade) skills were measured. Juel’s findings were disheartening: the statistical probability of readers with poor skills in first grade remaining poor readers in fourth grade was .88. The growing disparity between good readers improving with exposure and poor readers remaining struggling readers has been coined as the “Matthew effects” in reading (Stanovich, 1986). Ongoing research continues to support the notion that without early and intense intervention, poor readers will likely not reach their current grade level of proficiency (Juel, 1988; Lentz, 1988; Neuman & Dickinson, 2001; Snow, Burns, & Griffin, 1998; Stanovich; Torgesen, 1998; Whitehurst & Lonigan, 2001). Early identification and intervention for struggling readers provides them with the greatest opportunity for obtaining higher reading achievement. The immediacy of this challenge continues to grow as districts throughout the state of Ohio search for best practices, effective scientific-based reading research, and appropriate assessment tools to measure reading performance in primary grades to comply with the accountability measures outlined in *The No Child Left Behind Act of 2001 (NCLB, 2002).*
Purpose of the Study

The purpose of this quasi-experimental study was to assess the impact of alternative remedial reading strategies amongst second-grade at-risk readers using the Fast ForWord (FFW; Scientific Learning Corporation, 2010) computer-assisted reading intervention program and those using the traditional (teacher-based) classroom intervention approach in a suburban northwest Ohio school district. Additionally, the study examined the relationship between computer-based reading intervention and students with Individual Education Plans (IEPs), as Fast ForWord’s impact on gender. The control groups in three of the district’s elementary schools implemented 50-minute reading instruction using the district-adopted basal reading curriculum and 30-minute small group reading instruction. The remaining four classrooms located in one elementary school substituted 30-minute daily sessions in the school computer lab with FFW in addition to classroom instruction.

Theoretical Framework

The theoretical framework of this study is supported by several interrelated theories: Chall’s Development of Reading, the Literacy Achievement Gap and Matthew effects, and the early intervention theory. The developmental acquisition of reading is supported by Chall’s Development of Reading (1983) theory. Chall’s six-stage ‘scheme’ suggests reading develops over time in stages and at speeds unique to the individual, and development is contingent upon mastery of the current stage before progressing to the next stage. The stages are as follows:

Stage 0 - Prereading,
Stage 1 - Initial Reading, or Decoding,
Stage 2 - Confirmation, Fluency, Ungluing from Print,
Stage 3 - Reading for Learning the New: A First Step,
Stage 4 - Multiple Viewpoints,

Stage 5 - Construction and Reconstruction—A World View.

Of primary importance to this study are stages 0 and 1, which typically develop during the early primary grades (pre-K through second grade) and the stages in which children are learning how to read.

Assuming Chall’s (1983) assertion that each stage must be mastered before progressing to the next is necessary, early literacy preparation is essential to the success of teaching young students how to read. In recent years, this approach has been referred to as the theory of emergent literacy (Clay, 1991; Strickland & Morrow, 1989; Sulzby, 1985). Sulzby (1989) defines emergent literacy as “the reading and writing behaviors that precede and develop into conventional literacy” (p. 85). This period of preparation begins from birth as children are exposed first to spoken language and gestures, then to printed language. During stage 0 children should be exposed to and acquire an understanding of phonological awareness, phonemic awareness, the alphabetic principle, and concepts of print. As Chall points out, the quantity and quality of pre-emergent exposure and practice with these foundational skills determines the child’s reading readiness.

Gough’s and Tunmer’s (1986) Simple View of Reading reduced the complexity of reading into two major constructs: decoding and comprehension. The Simple View acknowledges the reading process as a very complex and not completely understood cognitive act and suggests that at a macrolevel reading (R) is the product of decoding (D) and comprehension (C), expressed as \( R = D \times C \). Decoding is the reader’s ability to cognitively recognize the grapheme (written symbols known as letters), the spelling pattern, attach the proper phoneme (discrete sound) to the grapheme, blend the phonemes, and identify the utterance as a word. Comprehension reflects the
reader’s ability to construct meaning from the printed text, which is the purpose of reading. Originally designed as a means of differentiating the primary source of difficulty for struggling readers, it has since become one of the ways to extend the identification as a tool for assessment, remediation, and intervention. The National Reading Panel (NRP) (National Institute of Child Health and Human Development [NICHHD], 2000) echoed the importance of decoding and comprehension in their findings and encouraged early identification and remediation of reading difficulties in the primary grades.

Quick and effortless word recognition (also referred to as automaticity) facilitates effective comprehension. LaBerge and Samuels (1974) linked the process of reading to the automatic information processing theory in cognitive psychology, which posits that cognition and learning are acquired as the brain receives, encodes, decodes, stores, and constructs meaning as it negotiates through several attention processes. In essence, the learner filter words and selects familiar stimuli in favor of new or unfamiliar visual, auditory, or sensory stimuli. Because of the individual’s ability to hold familiar information in memory and direct sensory and working attention to the new stimuli, the individual is able to perform rote tasks while cognitively devoting attention only to the new or unfamiliar task. As this pertains to reading, LaBerge and Samuels (1974) reasoned that the reader’s “attention can selectively activate codes at any level of the system, not only at the deeper levels of meaning, but at the visual and auditory levels nearer the sensory surfaces” (p. 295). However, it is likely the reader attends to only one code at a time, unless the reader receives stimuli from outside of the immediate attention which does not require attention. It is here LaBerge and Samuels suggest that readers who are able to automatically and accurately recognize a word at sight—automaticity— do not have to devote attention to decoding
print; the reader is able to attend to constructing meaning rather than decoding words resulting in fluent reading.

Readers who are unable to rapidly recognize words devote a large portion of attention and cognition to decoding, which leaves little energy or resources for comprehension, and creates a gap in literacy between poor and good readers as early as first grade. Slow decoding creates poor fluency; therefore, early identification and assessment of reading deficits assist teachers in the identification of struggling readers to inhibit a literacy achievement gap (Foster & Miller, 2007). Foster’s and Miller’s (2007) longitudinal study examined the literacy development trajectories of children receiving speech-language services in the areas of phonics/decoding and comprehension of the text. Early assessment identified at-risk students in kindergarten followed by intervention. Gaps between higher- and lower-performing group’s phonics performance were not closed until third grade, which is considerably slower than the normal developmental trajectory. Unfortunately, the achievement gap in text comprehension remained between the two groups. This gap, also referred to as the “Matthew effects” continued to increase, as the lower performing students were unable to reach the performance level of their peers.

Research confirming an achievement gap in literacy, the second theory guiding this study, began emerging in the late 1980s. Early research also revealed the predictive nature of literacy performance as early as the first grade. Alexander and Entwisle (1988) studied the development and achievement of children as they transitioned to full-time schooling from a number of racial, socioeconomic, sociocultural, and social-psychological perspectives. While their study focused primarily on social factors impeding student success of black and white children in later grades, their findings clearly pointed to a growing gap in performance between higher and lower performers as they progress through school. Bruck (1992) supports the apparent
gap as evidenced in children and adults with dyslexia. According to Bruck’s findings, readers with dyslexia are rarely able to perform at age appropriate levels in phonological and phonemic awareness (subskills of decoding). Participating adults performed no better on phonological awareness tasks than typical third grade students. Similar studies have echoed the growing gap between at-risk and typical students in literacy where the good readers continue to grow and develop and the weak readers continue to perform poorly (Juel, 1988; Stanovich, 1986; Torgesen, Wagner, & Rashotte, 1997). This “rich get richer and the poor get poorer” phenomenon is known as the Matthew effects (Stanovich), and it has major implications for at-risk readers in the early primary grades.

Science-related literature by Merton in 1968 introduced the Matthew effect. He coined the phrase as it related to the Gospel of Matthew in the Bible. The passage in Matthew 25:29 declares that more will be given to the one who possesses much and more will be taken from the one who possesses little. Although Merton applied this analogy to the dilemma of research and publication recognition in science, the principle of ‘the rich get richer and the poor get poorer’ was transferred to education to explain the growing gap in reading achievement between good and poor readers. Stanovich (1986) first related the principle to readers with reading disability, specifically those with dyslexia and very low phonological and phonemic awareness. His study concluded that good readers possessed skills early in the learning process which facilitated faster acquisition of print, a larger vocabulary, more enjoyment in reading, higher comprehension, and consequently, much more time spent reading; the additional time spent reading yielded developmentally appropriate growth. Struggling readers, on the other hand, experienced the opposite; difficulty in acquisition usually results in effects such as less reading, stilted vocabulary, and frustration. Hence, Stanovich coined this phenomenon the ‘Matthew effects’.
Consequentially, poor readers continued to fall farther behind in the developmental trajectory and were unable to close the widening gap between appropriate and current performance. Early identification of reading difficulties in the primary grades is imperative to closing this achievement gap because the acquisition of literacy skills begins before children enter formal education. Therefore, Stanovich’s definition will be applied throughout this study.

The emergent literacy theory proposes that the acquisition of literacy begins at birth and continues to grow incrementally throughout the reader’s life (Clay, 1991; Strickland & Morrow, 1989; Sulzby, 1985). Skills that form the foundation for the development of reading, writing, listening, and speaking emerge during the first six years of the child’s life. Skills such as the development of phonological awareness, phonemic awareness, an understanding of the concepts of printed materials, an understanding of the alphabetic system, acquisition of vocabulary, and meaningful exposure to a wide variety and quantity of literacy are predictive and directly related to the child’s potential for the acquisition of reading (Snow, Burns, & Griffin, 1998; Whitehurst & Lonigan, 2001). Therefore, reading instruction and intervention is extremely important during the pre-reading (Stage 0) and initial reading or decoding (Stage 1) stages.

Acknowledgment of the implications of the literacy achievement gap, the potential for the Matthew effects, and the responsibility of schools to provide reading intervention for at-risk readers as early as kindergarten call Ohio teachers, administrators, and legislators to identify at-risk readers and to respond with an effective intervention approach. The Committee on the Prevention of Reading Difficulties in Young Children (1998) recommended special attention be placed on the following areas: providing literacy instruction and support in pre-school and kindergarten with literacy instruction continuing until third grade and offering services and intense interventions for at-risk children to prevent reading failure. In light of Chall’s (1983)
stage theory, it is imperative that students reading below grade level be provided with reading intervention as early as possible to minimize the Matthew effects associated with reading achievement. The importance of early identification and intervention for at-risk students continues to be a priority in the NRP’s report and NCLB.

**Research Questions**

The research questions guiding this study were as follows:

1) Do Fast ForWord participants have significantly higher reading achievement than non-participants when controlling for pre-treatment differences?

2) Do Fast ForWord participants have significantly higher growth in reading test scores than non-participants?

3) Do reading test scores significantly differ based upon Fast ForWord participants with an Individualized Education Plans (IEPs)?

4) Do reading test scores significantly differ based upon Fast ForWord participants and gender?

**Significance of Study**

In light of legislation requiring schools to demonstrate Adequate Yearly Progress (AYP) and Value Added (VA), limited fiscal resources, more transparent accountability, and stagnant reading performance as measured by the National Assessment of Educational Progress (NAEP, 2008) assessment, educators are facing more curricular scrutiny than ever before. Reading performance has been one of the primary measures of the success of the education system as well as a measurement of teacher quality and financial efficiency; therefore, administrators must make well-informed decisions when purchasing intervention programs and curriculum. Fast ForWord, like many of the software programs utilized throughout the state and country, is an
expensive investment. This study examined data collected on word decoding and identification, oral reading fluency, retelling, and comprehension as measured by the Gates-MacGinitie Reading Tests (GMRT) and the Dynamic Indicator of Basic Early Literacy Skills (DIBELS) to assist stakeholders in the selection of the most effective and appropriate reading intervention.

This study should assist classroom teachers and, ultimately, administrators in several ways. Most importantly, the study should provide some insight into the effectiveness of computer-based intervention in remediating poor reading skills. It should also shed some light into populations who find greater success with computer-based intervention as opposed to traditional classroom instruction. Thirdly, it should help with the selection and implementation of the most appropriate and effective intervention strategies for struggling readers in the primary grades. Finite resources and fiscal responsibilities demand educators to be prudent in their selection of intervention and assessment materials.

**Definition of Terms**

*Comprehension* – Silent reading comprehension as measured by the Gates-MacGinitie Reading Tests (GMRT) measures the reader’s ability to accurately answer multiple choice questions related to the fiction and non-fiction grade appropriate passages. Students must select one of the three pictures that best answers a question about a segment of the passage (MacGinitie, MacGinitie, Maria, & Dreyer, 2002).

*Computer-based reading intervention*. Reading intervention curriculum delivered via computer software is referred to computer-based reading intervention.

*Decoding* – Decoding is the ability to “[apply] the letter-sound relations to transform printed words into pronunciations” (Ehri, 1999, p. 383), also known as the ability to sound-out words by attaching sounds to letters.
Oral reading fluency – Oral reading fluency is the reader’s ability to read text smoothly, at an appropriate rate, with accuracy, and with appropriate expression (prosody) ultimately resulting in improved comprehension (Harris & Hodges, 1995; Moyer, 1982; Rasinski, 1989; Zutell & Rasinski, 1991).

Reading achievement – Reading achievement is a holistic measurement of the reader’s ability to perform a variety of reading skills and cognitive processes via tests and/or assessments. Reading assessments measure the skills with a variety of texts and questions. The two primary domains of measurable skills correspond to Gough’s and Tunmer’s (1986) “Simple View of Reading”—decoding and comprehension. The breadth of constructs includes such skills phonological and phonemic awareness, decoding, word recognition, vocabulary, oral reading fluency, and comprehension (NAEP, 2008; NICHHD, 2000; Snow, Burns, & Griffin, 1998).

Reading intervention – Reading intervention is specific one-on-one instruction identified by appropriate assessment designed to target and strengthen reading skills to facilitate age-appropriate reading performance.

Retelling fluency – This measure of oral reading comprehension requires the reader to retell the portion of connected text read during the Oral Reading Fluency (ORF) portion of the DIBELS assessment. The assessor tallies the number of words the child uses to tell about what he/she just read in one minute (University of Oregon Center on Teaching and Learning, 2005).

Struggling readers – Readers whose reading performance is below age- or developmentally-appropriate norms with or without disabilities will be referred to struggling readers.
**Word Decoding** – Word decoding as measured by the Gates-MacGinitie Reading Tests (GMRT) measures the reader’s decoding and word identification skills (MacGinitie, MacGinitie, Maria, & Dreyer, 2002).

**Word Knowledge** – Word knowledge as measured by the Gates-MacGinitie Reading Tests (GMRT) measures the reader’s to understand the meaning of grade-appropriate words “likely to be known in speech and print by those Grade 2 students who possess good reading vocabularies” (MacGinitie, MacGinitie, Maria, & Dreyer, 2002, p. 9).

**Limitations**

Limitations for this study include the participants’ demographics, accessibility of student records and demographic information, the district’s “robust elementary technology integration”, the cluster sample as determined by classroom composition, and data collection errors.

The demographics of this study present the primary limitation of the study. The student population is 88.7% Caucasian (ODE, 2010d) living in a suburban community. Additionally, the district received the rating Excellent with Distinction during the 2008-2009 academic year. Such a rating indicates a higher-performing district. Research with non-Caucasian students in dissimilar communities and lower performing schools districts will likely produce different results. Therefore, the participants inhibit generalizability to other participants.

Participation in the treatment was confined to the student’s residency in one of the four elementary schools, rather than the child’s specific need. Participants identified with reading disabilities or impairments or with specific language impairments may have performed differently than the sample. Scientific Learning Corporation (2006) claims that Fast ForWord (FFW) provides “positive effects on a wide variety of student populations, including English language learners, special education students, academically at-risk students and students...
performing below their potential” (p. 3). The accessibility of student records or data concerning participation in additional reading support would also affect the study’s outcomes and predictability.

The third limitation may be the district’s implementation and integration of technology in the elementary schools. As previously mentioned, this district exposes students to technology very early, which likely creates ‘tech-savvy’ students and greater levels of comfort with computer-assisted instruction. Intervention results from students who are more familiar with the use of technology may skew their FFW results.

Another limitation of the study is the cluster sampling of participants. Participants were assigned classroom placement by the district. The lack of a random sample or assignment of group members influences the study results and group compositions.

The final limitation concerns the data collection methods. The Gates-MacGinitie Reading Tests were conducted by classroom teachers; however, some DIBELS assessments were administered and scored by reading teachers. The interrater reliability was not determined prior to administration. Accuracy in administration, collection, and recording of assessment data could have been compromised at any point in the process.

**Delimitations**

Two primary delimitations were established for this study. Data used for the study will be limited to students who completed both the fall and spring Gates-MacGinitie Reading Tests and DIBELS assessments for the purpose of making a pre- and post-assessment analysis on the effects of the Fast ForWord intervention. Data from all second grade classes in the district were used. IEP and gender demographic data were used to examine the relationship between computer-assisted intervention and students with special needs and gender.
CHAPTER II. REVIEW OF LITERATURE

“The key solution most frequently proposed for solving the problems that are currently plaguing humanity is education, and reading is basic to education. Education cannot proceed without reading, hence a compelling new objective is to increase literacy” (Smith, 2002, p. 287).

Chall’s Reading Development Theory

The quest to understand the complexity of reading from as early as ancient Babylonian times continues to be a topic of interest (Huey, 1908). “To the early peoples, reading was one of the most mysterious of the arts, both in its performance and in its origin” (Huey, 1908, p. 2), and some may say that it continues to confound and astonish even the most brilliant minds. Huey’s early work attempted to articulate the cognitive processes of reading and associated processes as they related to the history of reading, reading instruction and pedagogy, and the hygiene of reading. Much later Chall (1983) offered a stage scheme (more recently referred to as a theory) for the development of reading that has become the foundation for modern reading instruction and this study. The framework presumes that reading develops over time—a lifetime. Chall (1983) believes, “It takes most people about twenty years to reach the highest stage of reading development. Some do it much faster, others take longer, and still others may not reach it” (p. 7). Chall’s theory takes into account the interaction and influences of the reader’s biology and environment, the developmental acquisition of language, Piaget’s stages of cognitive development, exposure to increasingly complex texts, expanded “word knowledge” and vocabulary, and an increasing participation in the act of reading. It “focuses on what goes on in the person and in the environment to bring about reading development in each of the successive stages” (Chall, p. 10). Chall prefaces her developmental scheme with the reminder that
“individuals vary in their progression, yet most who are educated in typical schools tend to progress largely though the stages within the age limits listed” (p. 9).

The six stages of Chall’s (1983) reading development include Stage 0 - Prereading, Stage 1 - Initial Reading, or Decoding, Stage 2 - Confirmation, Fluency, Ungluing from Print, Stage 3 - Reading for Learning the New: A First Step, Stage 4 - Multiple Viewpoints, and Stage 5 - Construction and Reconstruction—A World View. Stage 0, or the pre-emergent stage of reading, most commonly encompasses children from birth to about six years of age. During this time, children receive their earliest exposure to graphemes (letters), phonemes (sounds), acquisition of phonological and phonemic awareness skills, environmental print, the alphabetic principle, and an awareness of print from their home and social environments. A brief description for each construct provides a deeper understanding of the complexity of the reading process.

Phonological awareness is the child’s ability to identify and discriminate the structures of spoken language such as syllables, words, phrases, sentences, and thoughts. Phonemic awareness is a discrete subskill of phonological awareness; it is the ability to identify, discriminate, and manipulate individual phonemes. Environmental print refers to letters, symbols, signs, or graphics that carry meaning in the child’s environment. The alphabetic principle is the understanding that English language is graphically-represented by graphemes, also called letters. Twenty-six letters represent the 44 phonemes in the language that can be written in both upper (capital) and lower (small) case letters in a variety of fonts. Awareness of print refers to the child’s understanding that print contains meaning and printed material has distinct features. The child’s ability to correctly hold a book, point to a word, point to a picture, trace the direction in which print is to be read, and understand that books contain meaning reflects an awareness of print (Adams, 1990; Chall; Durkin, 1966).
During Stage 0 children demonstrate a type of pseudo-reading. Initially, toddlers demonstrate this when they “babble” as they turn the pages of a book. Toddlers and early preschool children will later retell or “read” their favorite bedtime story to their parents. During this stage children tend to heavily rely on pictures and memory rather than print (Chall, 1983). Older preschoolers may even begin recognizing frequently seen words such as their name, “Mom”, or “Dad” as they begin attending to print. Chall reasons that at this stage children are much less concerned about attending to the print in books; they tend to be much more concerned about the meaning because they are unequipped to recognize print. She refers to this time as a time of “readiness”.

Stage 1 marks the beginning of children in grades one and two (ages six-seven) moving from their understanding of the text to cognitively understanding the relationships between graphemes and phonemes (also referred to as phonics). Children in this stage must be willing to depart from their “reading” to attending to the print. This stage has been described as a time of “guessing and memory game”, “grunting and groaning”, “mumbling and bumbling”, and “barking at print” (Chall, 1983, p. 16) as students make the abstract leap from recognizing letters to assigning particular sounds to the letters to blending them into meaningful units. The length of time for this connection to be made varies widely among readers depending upon prior knowledge, exposure to print, and phonological abilities (Adams, 1990).

In Stage 2 readers “confirm” what was learned during Stage 1 by reading familiar texts leading to more confidence and fluency. Familiar texts consist of stories, language, and story structure familiar to the reader. As they become more familiar with words, this facilitates faster, more enjoyable reading and construction of meaning. “It appears that most children learn in Stage 2 to use their decoding knowledge, the redundancies of the language, and the redundancies
of the stories read” (Chall, 1983, p. 18-19). Chall recommends immersing Stage 2 readers in familiar, authentic texts, even adult readers, to facilitate the development of oral reading fluency—the ability to read with appropriate speed, accuracy, and prosody. Readers are not yet using reading to learn, rather, they are nearing the ending stage of learning to read (Chall).

Stage 3 catapults readers into using text to learn new information and ideas. Early in this stage readers are moving from relying upon their listening and viewing skills for acquiring information to learning how to use text for learning. During this period readers are exposed to content-specific vocabulary, which requires them to use their prior knowledge and experiences to construct meaning for more abstract concepts and ideas. Readers begin to move from child-centered materials to more complex texts. Texts are longer and contain more complex concepts and higher vocabulary, requiring the implementation of higher orders of thinking than texts of previous stages.

The ability to analyze and evaluate materials is essential as readers move to Stage 4. Texts are much more complex and may require the readers to evaluate information from multiple perspectives. Chall (1983) suggests that this level of reading is most frequently acquired through formal education (high school) which forces the reader to grapple with more complex text structure, vocabulary, and abstract concepts.

Readers at Stage 5 read at a more advanced level than those at Stage 4. At this stage readers are able to read a wide variety of texts, deconstruct the information provided in the text, and then construct their own understanding of the information. This requires students to think at the cognitive levels of analysis and synthesis. Readers are also able to discern what should and should not be read, as well as which information is credible, relevant, and necessary for making their own judgment on the knowledge (Chall, 1983).
As with most stage theories, Chall (1983) believed the skills needed for each stage were predicated on the acquisition of skills in the previous stage. For children in the pre-emergent stage (Stage 0), she encouraged parents to take an active role in providing a literacy- and print-rich environment for their children as well as saturating them with a wide variety of read aloud stories, poems, and nursery rhymes. Chall’s theory surmises that the pre-emergent reader must first acquire phonological and phonemic awareness and an understanding of the alphabetic principal. Subsequent, sequential development leads to the acquisition of decoding and word knowledge, and automatic word recognition leads to oral reading fluency, which facilitates comprehension of the text.

One’s theoretical perspective of reading instruction is a reflection of how the reader acquires the skills necessary for the unnatural act of deciphering print. Some educators and research suggest a sequential approach to reading beginning with the smallest units of language (phonemes). Others support a more holistic and naturalistic approach. Others would insist that reading is uniquely complex for each reader; therefore, instruction is a combination of bottom-up and top-down approaches. This is the balanced or interactive approach. Still others insist reading is an interactive event encompassing all of the previously mentioned approaches plus the reader, the sociocultural and socioemotional factors surrounding the reader and the text, and the text. Understanding current situations are much richer when examined through the lens of the past; hence, a historical review of reading instruction and pedagogy in American public schools will provide a framework for understanding of how and why educators teach reading as they do. It will shed light on the cyclical shifts seen in intervention and strategies for creating effective readers over the past 400 years.
Reading Instruction and Pedagogy in the United States

A History of Reading Instruction.

Reading instruction in American public schools has moved along a continuum of extremes since colonial times, heavily influenced by the centuries of instruction preceding current methodologies. Smith (2002), a noted historian of American reading instruction, writes that instructional developments and approaches to teaching reading reflect social, economic, and political trends as well as scientific findings. An extensive look at this rich history provides a detailed backdrop for how reading was, and continues to be, taught in America and how it is responding to more recent innovative and technological tools.

American reading instruction from 1607-1776. *The Period of Religious Emphasis* (1607-1776) in colonial America reflected the new colony’s British heritage. As in most of Europe, the Church controlled the education and religious and political preparation of the wealthy, white male child in preparation for service to the country or the church. Students tended to be the sons of the elite, political, and religious leaders of the time. This precedent perpetuated the mission of the early public school to prepare literate students to serve God and to read the Bible (Smith, 2002).

Reading instruction during this period reflected the same pedagogy British teachers used to teach students the ancient languages of Latin and Greek (Smith, 2002). Teachers delivered instruction in a direct, explicit manner to multi-age classes. The primary responsibilities of the students included listening, memorizing, and regurgitating the material delivered to the entire class. A common reading practice included the teacher demonstrating an oral reading of the assigned primer, then instructing the students to practice the text for mastery. Students demonstrated their reading skills in oral reading either at the teacher’s desk or in front of the entire class. Oral reading then moved to reading simple passages or paragraphs (Smith).

American reading instruction from 1776-1840. According to Smith (2002), the shift from providing a religious education to a more secular education became the trademark of *The Period of Nationalistic-Moralistic Emphasis* (1776-1840). The growing and developing nation stimulated shifts in priorities and goals of public education. By the early 1800s, publishers began replacing religious texts with politically-charged texts aimed at creating a stronger nation and an educated citizen. Many of the verses and rhymes were replaced with expository texts focusing on history and citizenship.
Pedagogically, little changed in the instructional approach to teaching reading during late 18th century. Beginning readers continued to learn to read via the bottom-up alphabetic method, teachers delivered instruction to the entire class, and students continued to learn in multi-age classrooms. Peer reading or buddy reading with older, more skilled readers supplemented teacher-directed instruction (Smith, 2002). Simultaneously, a new pedagogy was beginning to make its way to the new United States.

American reading instruction from 1840-1880. The Period of Emphasis on Education for Intelligent Citizenship (1840-1880) ushered in many changes to the American public education system. The most influential shift during this time may have been the adoption of the German and Pestalozzian principles (Smith, 2002). This methodology was much more holistic than the current teacher-centered approach and supported the use of objects to illustrate words and their meanings. Pestalozzian principles called for child-centered teaching as opposed to the teacher-centered instruction of the previous century. This child-centered approach slowly gained support from scholars, most notably Horace Mann, and challenged both instruction and instructional materials (Adams, 1990; Smith).

It was during this period that early reading instruction began placing more emphasis on the sounds (phonemes) represented by letters (graphemes), rather than letter names; this became known as the Alphabet-Phonetic Method (Adams, 1990; Smith, 2002). Teachers emphasized the close connection between spelling and reading by introducing dictation and copying text. Classroom composition continued to be multi-age as students were beginning to remain in public education for longer periods of time; older students were often tasked with helping younger children as the teacher conducted oral reading or math assessments or targeted instruction (Smith). The use of older students and small groups provided an effective method for the use of
newly published leveled readers. Currently, this concept is referred to as partner or buddy reading.

**American reading instruction from 1880-1910.** The purpose of reading instruction experienced a paradigm shift during the next significant period of instruction in the United States. It was during 1880-1910 that the objective for teaching one to read shifted from preparing a loyal and literate patriot to purposefully developing an interest in and an appreciation for literature. Herbartianism was quite influential in the shift toward the inclusion of literature in public school curriculum and the effectiveness of its use (Smith, 2002). Herbart, a German educator, was a proponent of using interesting and relevant literature and historical works to teach character, rather than dry primers and readers (Smith). Likewise, the *Period of Emphasis on Reading as a Cultural Asset* also emphasized the importance of constructing meaning from the text (comprehension) and the ability to read with expression and elocution (prosody).

The advent of scientific reading research brought significant changes to the field of reading. Early American studies were important for two reasons. According to Smith (2002), “They were first to call attention to rate in reading, distinctions between silent and oral reading, and individual differences in reading” (p. 146). Prior to 1880 oral reading was the primary method by which students learned to read (Hyatt, 1943). Secondly, even though they were initially “psychological and physiological in nature and had to do with such aspects of reading as eye-movements, visual perception, and inner speech” (Smith, p. 146), they ushered in scientific-based research which would be instrumental in the diagnosis and study of reading disability.

Several major developments in reading instruction had their genesis in this period. Research led to the publication of professional books on reading, separate courses for the study of reading, and new alphabetic and phonetic systems (Smith, 2002). Growth in the understanding
of the reading process ignited the resurfacing of the debate on silent reading versus oral reading and pummeled the pedagogical approach of teaching and assessing reading orally. Many researchers believed the emphasis on oral reading was amiss considering that the majority of reading in one’s life is silent reading (Mirick, 1914). Creating a lifelong appreciation of literature as a valuable commodity of a cultured nation remained the primary focus of reading instruction throughout the turn of the century and likely led to the inclusion of color illustrations and literature in basal readers as a way of enticing leisure reading (Smith).

**American reading instruction from 1910-1924.** As the nation and public education system responded to the emergence and explosion of the scientific revolution of the early 1900s, so did reading instruction. *The Period of Emphasis on Scientific Investigation in Reading* (1910-1924) birthed the scientific-based research of reading and learning. Prior to the explosion of research, reading instruction “was mechanical and very simple” (Mirick, 1914, p. 8). The advent of formal assessment challenged the simplistic instructional approach. Referred to as the first formal assessment, the *Thorndike Scale of Handwriting Assessment* (1910) made it possible to quantify learning. The scientific investigation of education, and later reading, was marked by an “entirely new emphases embracing silent reading, speed, reading disability, and other innovations” (Smith, 2002, p. 185). This shift moved research from the laboratory into the classroom where researchers began gathering data on reading methodology, instructional materials and curricula, and the complex process of reading.

Undoubtedly, this period was a time of unprecedented growth and exploration of research in reading and its implications for instruction (Smith, 1961). One of the most popular topics of study during this period was silent reading. The first standardized tests focused on silent reading speed and comprehension, reading instruction, assessment, and research. New research paved the
way for other innovative approaches to teaching, such as the use of perception cards, experience charts, one-on-one reading instruction, grouping of students in reading groups, differentiated instruction and assignments, and teacher preparation. New instructional tools were integrated in a very teacher-directed manner and perpetuated the bottom-up approach of teaching reading.

**American reading instruction from 1925-1935.** The Period of Intensive Research and Application (1925-1935) was a decade of significant philosophical debate and conceptual shifts in the world of reading, especially relevant to this study such as the theoretical approach to reading, ability grouping, reading remediation, and reading readiness. The number of scientific studies conducted in classrooms by teachers grew, and the charge to begin modifying instruction to reflect the findings of research began challenging teachers in classrooms around the country (Smith, 1961). The three most prevalent areas of study included “silent reading, individual differences, and remedial reading” (Smith, p. 142). On one side of the continuum of instruction were teachers who believed the most effective method of teaching reading must begin with alphabetics, phonics, and teacher-directed instruction in drill; this is the bottom-up approach. Those on the opposite side of the continuum, the top-down approach, argued that children learn to read and write most effectively by using their own language and experiences (later coined the Language Experience Approach) (Smith, 2002). Proponents of the bottom-up approach contended that teaching children phonemes, then words would provide them with a foundation for word recognition and spelling, which mirrored the approach of previous periods and the instruction of the Ancient Languages. Opponents retorted that this artificial approach disconnected the child from the learning process and personal experiences. It is here that the Great Debate began.
As influential as the shift to a more inclusive and balanced practice of silent and oral reading was the acknowledgement of the wide array of abilities in reading within the grade band (Smith, 1961). The measurement of reading performance illuminated significant differences classroom teachers found amongst their pupils. This issue led many teachers to the reconstruction of their classrooms and the adoption of teacher-developed differentiated instruction and assignments, small reading ability groups, and the implementation of flexible grade and grouping promotion (Smith).

Another very important shift during this period was the recognition of reading disability and remedial reading. According to Smith (1965), “the term remedial reading did not appear until the middle of this period” (p. 191). Prior to this, researchers described struggling readers as readers having “inferiority in reading, reading disability, and reading deficiency” (Smith, 1965, p. 191). In fact, more research was conducted on remedial reading during this period than any other subject (Smith, 2002). Smith credits Samuel T. Orton as the founder of the theory of cerebral dominance and was the first to suggest that readers who struggled with reading disability might actually be suffering from “left or mixed laterality-handedness, eyedness, and footedness” (p. 240). Fernald developed the kinesthetic method of remediation and the first reading clinic for the remediation of reading difficulties (Smith, 1961, 2002). Struggling readers traced the letters of words and pronounced the word in the kinesthetic and tactile methods. More currently, the Orton-Gillingham Method (Gillingham & Stillman, 1997) advocates the use of a variety of textural experiences as children trace letters and write words. These innovations may have been the first attempts at understanding the neurobiology of reading, which will be discussed in greater depth in Chapter V.
Another significant development during this period was the concept of reading readiness (Smith, 1961, 2002). Schools evaluated students who were preparing to enter kindergarten in 1926 for their preparedness for formal reading instruction (Smith, 1961). The philosophies of Rousseau, Pestalozzi, Forebel, Herbart, and Dewey cemented the concept of reading readiness in American reading instruction (Smith, 2002). Previous instructional theory suggested children not be taught to read until they were about eight years of age, at which time they were cognitively and developmentally more prepared for this arduous cerebral process (Smith, 2002). Rather, proponents of reading readiness argued that time should be spent preparing students for reading prior to formal instruction, which is consistent with the contemporary theory of emergent literacy. As with most innovations, the concept of pre-assessing reading skills prior to entering kindergarten grew slowly. The pinnacle of this construct would occur during the 1930s (Smith, 1961).

The onset of World War II sent what appeared to be conflicting messages to teachers of reading. The redistribution of resources to fund the war resulted in a reduction of educational research and production of educational reading materials, whereas the call to protect democracy and the nation resulted in an increase in the merit of reading in America (Smith, 2002). This renewal resulted in an emphasis on more rigid systematic reading instruction, a move toward drawing the older population to reading, and an increase in the production of teacher manuals (Smith). In a politically-charged book, Rudolph Flesch (1955) argued, “There is a connection between phonics and democracy—a fundamental connection. Equal opportunity for all is one of the inalienable rights, and the word method interferes with that right” (p. 130). The fallout from Flesch’s work rocked the country and fueled the ‘great debate’ between phonics and the holistic approach to reading (Smith, 1963, 2002).
Reading instruction became much more directive and traditional during these years. Notable changes in reading instruction during this period were vibrant and hopeful, which reflected the renewal of peace around the world. Teachers began incorporating more student-centered practices, such as using play to facilitate discovery, more classroom activity and play, the inclusion of brightly-colored books, and self-selection of reading materials (Smith, 1963).

**American reading instruction from 1935-1950.** *The Period of Internal Conflict* (Smith, 2002) was a time of international conflict which negatively influenced reading research, but positively influenced the importance of reading in developing a democratic nation during the period of 1935-1950. Smith (1963, 2002) notes six significant effects: (1) Scientific research substantially diminished during World War II, as much of the country’s resources were poured into the war effort; (2) An increase in the creation and publication of instructional reading materials and research began to increase; (3) Social and political leaders began touting the importance of reading in building and maintaining a strong democratic nation; (4) A staggering number of adult non-readers were discovered in the military which stimulated a widespread response of reading instruction; (5) The seriousness importance of reading launched a nationwide call for a more intentional, systematic reading instruction; and (6) The radio became accessible and began drawing readers from the books to the airwaves. Hyatt (1943) conducted a study and a push to reintegrate more oral reading in the schools because “oral reading requires abilities that are not needed in a silent-reading situation” (Hyatt, p. 2) during this period as well. Calls for a change in reading instruction began brewing.

Several new approaches to reading and diagnostics surfaced during this era. The importance of reading readiness in methods of reading instruction, the inclusion of structural analysis and contextual clues in word recognition, the importance of visual and auditory
discrimination, the implementation of flexible grouping, and the distinction between recreational and work-type reading were amongst the most notable discoveries of the period (Smith, 2002). The field saw a notable increase in the interest of causation of reading disability, diagnostics, remediation, and supervision. The multiple-causation theory of reading disability suggested that the complexity of reading disability mirrored the complexity of its causes; therefore, “the pooled opinions of several experts in varied fields is more reliable than opinion of a reading examiner alone” (Robinson, 1946, p. 235-236). Research resulted in the development of new diagnostic tools, such as the telebinocular, opthalmagraph, metronoscope, the tachistoscope, and Harvard tapes, to investigate the physiological components (eye movement) of reading (Smith).

The interest in reading disability naturally led to the assessment and diagnosis of difficulties as well as the exploration of remediation, more recently referred to as reading intervention. The use of reading clinics became quite popular in schools and served to provide targeted and intensive study and remediation of reading disabilities (Smith, 2002). The classroom teacher or reading supervisor using basal reading materials as the primary text conducted early remediation in small groups in their classroom (Smith, 2002).

Prior to 1950, classroom teachers or reading supervisors delivered reading instruction and remediation. In spite of the technological advances of the period, Betts (1949) called for the need to prepare and equip teachers with more support and instruction in order that they might “discover individual needs and to provide the necessary differentiated instruction in reading” (p. 283) to their struggling readers. His call reflected his understanding of the complex nature of reading and the equal complexity of the children learning how to read; many still echo his call for investment in teachers as one of the most effective tools for reading intervention.
The need for remediation and the study of children with profound reading difficulties led to the development of reading clinics located in public schools (Smith, 2002). The clinical model served to provide remedial reading teachers with the means to assess and diagnose possible causes for reading disability. Not all remedial reading rooms were clinics in the strictest sense of the word, rather they served as specific areas for reading teachers to troubleshoot possible reasons and causes of reading deficiencies (Smith).

**American reading instruction from 1950-1965.** The final period of reading instruction Smith (2002) addresses is *The Period of Expanding Knowledge and Technological Revolution* (1950-1965). The reader will notice that much of Smith’s description is quite relevant to the present era, further analyzed later in the paper. Smith describes this era as being pivotal to the surge of new ideas and methods for teaching American students how to read effectively. Legislators and public officials recognized the importance of reading in maintaining democracy, leadership, and the American way of life; this motive mirrors those of the forefathers during *The Period of Emphasis on Education for an Intelligent Citizenry* (1840-1880). As in earlier times, “the key solution most frequently proposed for solving the problems that are currently plaguing humanity is education, and reading is basic to education. Education cannot proceed without reading, hence a compelling new objective is to increase literacy” (Smith, 2002, p. 287). Public education for all seemed to be the only way the United States could successfully guard against the infiltration of communism, reduce the jobless rate, reduce poverty, and protect the economic state of the country.

The impetus for this redirected focus was the successful launch of the Russian satellite *Sputnik* in 1957 (Allington & McGill-Franzen, 2000; Smith, 2002; Walker, 2008). The launch sparked fear that if the American public schools were not intentionally improving education, it
was likely the country would fall prey to Communism. This fear targeted reading instruction. Never before had teachers of reading in the United States found themselves under such merciless scrutiny and ridicule. Comparative studies conducted between the ‘old’ and ‘new’ ways of teaching in an effort to identify blame positively supported current public school reading instruction. Nevertheless, the public scrutiny caused educators to re-examine reading instruction and methodologies, engage in scholarly research and the exploration of existing programs, practices, and curriculums, and it sparked interest in reading instruction throughout society (Smith, 2002).

Chall (1983) asserts that the third major revolution—the knowledge revolution—is requiring readers to be much more advanced than those during the previous agricultural and industrial revolutions (Smith’s first three periods and following four periods respectively). This knowledge revolution is marked by the precipitous creation and dissemination of knowledge, technology, and communication. Literacy in the late twentieth century requires new skills, more critical thinking, and more efficient reading (Chall, 1983).

Alexander and Fox (2008) provide a more recent cumulative analysis of five eras in reading instruction and research beginning with Smith’s Period of Expanding Knowledge and Technological Revolution. Although Smith saw this time period as a time of expansion and technological growth, Alexander and Fox see it a bit more dismally. The Era of Conditioned Learning (1950-1965) connotes a period of control and behaviorism. They echo the growing importance, if not paranoia, of education and reading as the country’s defense for the encroachment of communism after World War II, the launch of Sputnik, and their ability to compete globally. However, they attribute the growing popularity of behaviorism as support for Flesch’s (1955) charge to return to the synthetic method of teaching phonics to ensure better
readers through the deconstruction of the reading process into discrete constructs and skills. This shift led to a “very linear, sequential mode of controlled instruction” (Alexander & Fox, p. 15) and was reflected in the creation of specialized texts and classes for language arts subjects and controlled texts and basal readers (Allington & McGill-Franzen, 2000). This “drill and kill” approach to reading was very teacher-directed and the student was the passive receiver of information and instruction (Alexander & Fox).

Moreover, the adoption of a medical model to the assessment and diagnosis of reading difficulties perpetuated the dissection of the reading process into individual skills. Researchers concentrated on trying to establish a sequence for teaching reading skills in an effort to reduce the growing numbers of struggling or disabled readers. Following the clinical medical model, struggling readers were assessed, diagnosed, prescribed specific interventions for the areas of weakness, and re-evaluated (Alexander & Fox, 2008). Unfortunately, this approach did not yield effective remediation of reading difficulties, which likely fueled the move toward a more holistic approach to reading instruction.

**American reading instruction from 1965-1975.** The Era of Natural Learning (1966-1975) approached reading instruction from a much more holistic and naturalistic perspective than did the previous era. The collaboration of linguists, sociolinguists, and psycholinguists with reading and education researchers produced a body of works suggesting that just as language is learned naturally in the child’s environment (Chall, 1967; Halliday, 1969), so is reading when provided in print-rich environments and meaningful contexts (Goodman & Goodman, 1979). Educators shifted curricular direction toward integration. Teachers were more concerned with providing students relevant and engaging texts with less controlled vocabulary to reflect the natural language of the readers’ environment (Alexander & Fox, 2008).
Simultaneously, education began leaning more heavily on “cognitivism as a dominant theory of learning” (Alexander & Fox, 2008, p. 15). This new direction influenced a paradigm shift in the assessment, diagnosis, and treatment of reading difficulties. Rather than trying to isolate weak skills, holistic researchers examined the reader as an individual and the acquisition of reading as individualistic. This led to the use of miscue analysis (Goodman, 1965) as a means of looking at the reader’s unique approach to constructing meaning from the printed text. Miscue analysis continues to be used to direct reading intervention. The growing interest in cognition led researchers to a deeper study of the brain and a shift in reading research.

**American reading instruction from 1976-1985.** Researchers studying the brain and learning began developing new theories to explain the complex process of reading. One of the first theories stemmed from the information processing models positing that the brain processed information in a serial manner much like the computer. The computer metaphor depicts the focus of reading instruction during Alexander’s and Fox’s (2008), *Era of Information Processing* (1976-1985). Paramount to this model was the contribution of prior knowledge to comprehension of text. Gough (1972) studied the mental processes from the information processing perspective and surmised that while reading, the reader must attend to the entire visual field before the brain will begin attaching meaning to the letters. This perspective hinted at the importance of prior knowledge in comprehension (in this case, the knowledge of the grapheme-phoneme relationship), but failed to make the connection. LaBerge and Samuels (1974) extended the information processing model to include the necessity of automaticity (ability to process without conscious effort) of each component process; again, reflecting a heavy reliance upon prior knowledge.
In 1985, Rumelhart introduced two major theories. The interactive model of reading posited that multiple processes occur simultaneously and flexibly as deemed necessary by the text. This theory has become one of the four theoretical perspectives of teaching reading. His schema theory stated that bits of information connect to bits of information previously acquired in order for the reader to make meaning from the text. “Learning was presumed to occur when information from the environment (text) became part of an individual’s knowledge base—a process that involved the input, interpretation, organization, retention, and output of information” (Alexander & Fox, 2008, p. 17). This theory supported and in some ways explained the role of prior knowledge in the construction of meaning from new material.

The transactional theory of reader response also emerged during this period. In response to the information processing model, teachers ascribing to the bottom-up approach tended to push young readers toward efficient and effective reading through strategies and processes, while more holistic educators worked to preserve the enjoyment (aesthetic) approach to reading. In *Literature as Exploration*, Rosenblatt (1938) posited that the act of engaging in a text was an event, which encompassed much more than the acquisition of knowledge; it was experiential and very holistic. She writes,

The special meaning, and more particularly, the submerged associations that these words and images have for the individual reader will largely determine what the work communicates to him. The reader brings to the work personality traits, memories of past events, present needs and preoccupations, a particular mood of the moment, and a particular physical condition. These and many other elements in a never-to-be-duplicated combination determine his response to the peculiar contribution of the text. (pp. 30-31)
This perspective became the foundation for her transactional theory of reader response. The theory suggests that readers approach a text with the intent to either read for pleasure and enjoyment (aesthetic) or for the acquisition of knowledge (efferent). Several years passed before this theory was accepted.

An increase in federal funding stimulated and supported a large volume of research on effective reading instruction and intervention during this period. In response to information processing theories, instructional emphasis was placed on teaching strategies rather than skills for efficiency and effectiveness (Alexander & Fox, 2008; Allington & McGill-Franzen, 2000). Teachers began redesigning intervention; the previous approach to intervention focused on remediating weak or absent skills. Strategy-based intervention during the early 1980s was not very successful, which may have led to the next wave in reading instruction and intervention.

**American reading instruction from 1986-1995.** During *The Era of Sociocultural Learning* (1986-1995, Alexander & Fox, 2008), the approach to learning took a sharp turn toward social constructivism—the idea that learners learn experientially as they participate in the learning event and that learning is influenced by the learner’s social and cultural influences. Social constructivism is an amalgamation of both developmental theorists, such as Piaget (1967), Vygotsky (1978), and Bruner (1961), and social cognitivists such as Miller and Dollard (1941) and Bandura (1977). In essence, this learning theory combined the importance of prior knowledge, the learner’s culture and environment, and the holistic approach to explaining how learning occurs. Researchers were much more concerned about how the learning occurred than about the products of learning and more inclusively redefined knowledge to include the acquisition of any new information rather than specific bodies of knowledge canonized by publishers or legislators. The concept of “conditionality” suggested knowledge was not neutral;
there is accurate and substantiated knowledge just as there is inaccurately and poorly supported knowledge. Therefore, readers need to know how to discern and critically analyze texts (Alexander & Fox). During this period, “social and contextual forces mattered greatly in reading and reading instruction” (Alexander & Fox, p. 20) and ushered in the current era.

**American reading instruction from 1996-present.** The exponential growth of technology and communication demanded education to begin reconstructing existing paradigms. The first paradigm shift during *The Era of Engaged Learning* (1996-Present) was the redefining of text. Alexander and Fox (2008) report, “Where texts were once seen only as printed materials (e.g., books or magazines) read in linear fashion, they now encompassed all manner of communications that students encountered daily, including the nonlinear, interactive, dynamic, and visually complex materials conveyed via audiovisual media” (p. 20). Teachers began integrating alternative forms of text in their classrooms to help prepare their students for the rapidly changing forms of print. A more subtle shift occurred as greater interest in reader motivation and interest in reading encroached upon the notion of reading solely for the purpose of gathering information. Thirdly, researchers also began looking at the reader as experiencing a lifetime of on-going reading growth (Chall, 1983). This perspective acknowledged the reader’s active participation in the reading process and during reading instruction.

This era continues to experience emerging areas of interest and research. However, integral to the nature of this study is how researchers and educators are beginning to look at the following three topics: component skills for intervention, the influence of high stakes testing on reading performance, and more recently, the neurobiology of reading (Alexander & Fox, 2008). More attention will be devoted to each of these constructs and their relationship to effective reading intervention in the modern classroom.
As Alexander and Fox (2008) point out, reading research and instruction over the past 400 years has been dynamic as it responds to the social, political, and scientific influences of the age, yet consistent. The “great debate” continues to rage between phonics and whole language; the need to focus on the individual or the group; the use of controlled texts or authentic texts such as newspapers, children’s literature, Internet articles; and the need to focus on content-specific knowledge or more generalized knowledge. There also appears to be shifts in the emphasis placed on the physiological, psychological, and social constructs of reading. The dynamic nature of research in the area of reading seems to indicate an on-going interest in trying to understand the complexities of the reading process and reading instruction. Alexander and Fox also encourage educators and researchers to maintain “a healthy skepticism toward today’s innovations or promising techniques” (Alexander & Fox, p. 24). Such skepticism will cause interested parties to look back over the history of reading instruction and forward to the emerging changes of the 21st century in pursuit of the most effective methods for reading instruction, intervention, and assessment as they relate to reading development.

Approaches to Reading Instruction

As mentioned in the discussion of the history of reading instruction in the United States, there has raged “a great debate” as to which method for teaching reading is most effective. No definitive answer has emerged; therefore, all four will be briefly discussed to provide an understanding of current reading instruction and practice in the United States concerning word decoding, word knowledge, oral reading fluency, and comprehension. The synthetic, or bottom-up, method will be examined first followed by the authentic, or top-down method, the interactive or eclectic approach, and finally, the transactional approach.
**Synthetic approach.** The synthetic approach is also known as the bottom-up approach or phonics. Phonics, the study of the grapheme and phoneme relationship, is perhaps one of the oldest approaches to reading in American education (Smith, 2002; Walker, 2008). In phonics, readers “start at the bottom, with individual letter-sound correspondences and successively work up through the higher-level skills” (Adams, 1990, p. 238). Early phonics instruction was “mechanistic” (Walker). In this approach words are sounded out letter-by-letter as opposed to being recognized as a complete unit, as opposed to the authentic, holistic acquisition of spoken language. Gough’s (1972) model suggests that the reading process is a series of sequential triggers beginning with the visual recognition of a symbol that triggers a series of other processes. This recognition triggers a cognitive connection to a letter, then a phoneme, and eventually a word. Once the group of letters is identified as a word, the word is connected to meaning. Stringing the meaning units together eventually results in a meaningful construction of ideas from print. Hence, it became known as the synthetic approach.

The teaching of phonics was banned during the late 1930s; however, a modified instructional model for teaching phonics appeared in the early 1950s. Walker (2008) notes, “Phonics [was] taught more gradually, in the context of meaningful reading, usually appearing in the second and third grades” (pp. 34-35). Analytic phonics linked whole word recognition with phonics as readers analyzed the phonetic components of sight words. Linguistic-phonics (Fries, 1963) asserted that within the English orthographic system there are patterns that occur frequently that enough readers could memorize the patterns and use them to decode unknown words, supporting the value of including phonics as a primary component of formal reading instruction.
A second model, LaBerge’s and Samuel’s (1974) model of automaticity, nicely straddles both a bottom-up and a top down approach. LaBerge and Samuels posit that the reader must processes information in a series of stages before higher level processing can take place. According to this model, visual, phonological, and semantic memory systems facilitate reading. Systems can be bypassed, but the hierarchy of systems cannot be circumvented, hinting at the possibility of performing higher-level processes before attending to lower level functions. They assert that readers have limited attention; therefore, if readers can develop automaticity in word recognition, more of their cognitive efforts are used for comprehension.

Proponents of phonics defend their approach with two strong arguments: Phonics produces stronger decoders and stronger spellers (Adams, 1990; NRP, 2001; Smith, 2002). Chall (1967) explains, “Judging from the studies comparing systematic with intrinsic phonics…we can say that systematic phonics at the very beginning tends to produce generally better reading and spelling achievement than intrinsic phonics, at least through grade 3” (p. 114). However, the debate continues.

Opposition to the teaching of phonics can be found as early as 1614 by Lubinus and his proposal for a whole word method for teaching reading (Groff, 1987). The Germanic and Pestalozzian principles of a holistic approach to teaching continued to challenge the effectiveness of phonics and its artificial approach to language and learning (Adams, 2002; Groff, 1987). Some asserted that this rigid, uniformed approach removed enjoyment from learning (Groff). Samuel Worcester was the first American to advocate shifting American reading primarily to a whole word method (Adams; Groff). Prior to the major acceptance of the whole word method at the beginning of the 19th century, Rice (1893) wrote that
In schools conducted upon the principles of unification, language is regarded simply as a means of expression and not as a thing apart from ideas. Instruction in almost every branch now partakes of the nature of a language-lesson. The child being led to learn the various phases of language in large part incidentally while acquiring and expressing ideas…And strange as it may seem, it is nevertheless true that the results in reading and expression of ideas in writing are, at least in the primary grades, by far the best in those schools where language in all its phases, is taught incidentally. (pp. 223-224)

Shortly thereafter, educational leaders Colonel Francis Parker, John Dewey, and G. Stanley Hall from The University of Chicago persuaded the educational community of the shortcomings of phonics and the modern movement toward whole language began (Groff, 1987). Contrary views continued to surface in the literature from those ascribing to a more holistic and naturalistic perspective to the acquisition of language and came mainly from Frank Smith and Kenneth Goodman (Goodman & Wilde, 1985; Goodman & Goodman, 1978; Smith, 1971). Opponents claimed that phonics impairs comprehension, frustrates readers because of English’s inconsistent spellings and sight words, contradicts the natural acquisition of spoken language (and therefore written language), and disregards the importance of dictionary use, word length, structure, syllabication, and individual approaches to learning (Groff). Rummelhart (1976) noted that Gough’s ‘bottom-up’ model is predicated on the notion that “the information flow is totally ‘bottom-up’. That is, the information is initiated with the sensory signal and no higher level of processing can effect[sic] any lower level” (p. 4). Proponents of the whole word method would experience slow, but consistent support throughout the 20th century.

**Authentic approach.** The whole language, top-down, or authentic approach to teaching reading “integrates the holistic, psychological research of Piaget, Vygotsky, and schema theorists
with the social, functional-linguistic research of Michael …to guide classroom decision making” (Goodman, 1989, p. 207). Teachers of whole language see themselves as facilitators of social learning rather than distributors of knowledge as they guide children naturalistically and authentically through Halliday’s (1981) three phases of language development: “learning language, learning through language, and learning about language” (p. 7). Kenneth Goodman is most frequently credited with launching the whole word, top-down, or look-say approach to teaching reading, which reflects his belief in the social construction of language constructs. The roots of Goodman’s notion that spoken and written language is socially acquired in meaningful and authentic units rather than in individual sound units (phonemes) stems from the research of Noam Chomsky and generative language (Chomsky, 1966). The generative language theory posited that children learn language and a deep understanding of the grammar of a language based on “the data available to [them]” (Chomsky, p. 591). In other words, the child’s acquisition of language is dependent upon the child’s social environment and context of the language, as opposed to learning language phoneme-by-phoneme in isolation of meaning (also referred to as descriptive grammar). Chomsky’s cognitive approach to linguistics was holistic and contrary to the behaviorists of this time. Goodman (1984) expanded the work of Chomsky to create the transactional, psycholinguistic theory of the reading process as he analyzed the miscues (errors) in children’s reading.

Teachers of the whole language approach take a Deweyian, child-centered approach to instruction, that is, they “start where the learner is” (Goodman, 1989, p. 209). This approach acknowledges the contribution of prior knowledge and text predictability to the reader’s word recognition and construction of meaning in the text (Goodman, 1965, 1989).
**Interactive approach.** Instructing reading as a complex combination of phonics, word decoding, and comprehension skills began quite early in American reading instruction. David B. Tower (1853) introduced a more balanced approach to instruction in his reader, *The Gradual Primer*. Teachers began reading instruction by first introducing words with few letters, as opposed to teaching letters in the word (Smith, 2002). The Ward Rational Method in Reading (1894) was a compatible partner of a more friendly blend of the phonics and whole word method whereby the reader learned words first. Words provided the context for teaching phonics principles. As the ‘great debate’ waged in the mid-1920s, William S. Gray, in the Twenty-fourth Yearbook for the National Society for the Study of Education (Whipple, 1925) urged educators to blend the skills approach of reading with literature to provide a more balanced approach to reading instruction. Adoption of this approach was meager until the mid-1970s.

In 1985, Rumelhart proposed the notion of an interactive approach to reading. Scholars of the synthetic models believed in first developing language skills, then targeting comprehension. Linguistic skills included the reader’s “ability to perceive and segment words, syllables, and phonemes from the speech stream” (Yopp & Singer, 1985, p. 135). Contrary to Rumelhart, authentic proponents believed in teaching metalinguistic skills first. Such skills include “knowledge about one’s own language and ability to direct, regulate, monitor, and evaluate” (Yopp & Singer, p. 135). Rumelhart suggested that the reading process was the sum of both systems (perceptual and cognitive) working simultaneously (parallel processing) and flexibly as the reader processed written text. He pointed out that readers’ perception of letters is often dependent upon their perception of the syntactic and semantic context in which they encounter the words (Rumelhart).
**Transactional approach.** The transactional approach to reading comprehension sees reading as an event rather than a set of discrete skills or goals in isolation. In many ways, this approach melds and extends the interactive approach to include the sociocultural context of the reader and the text, reader response, and the aforementioned psychological theories (Dewey, 1913; Dewey & Bentley, 1949; Pressley, El-Dinary, Gaskins, Schuder, Bergman, Elmasi, & Brown, 1992; Rosenblatt, 1938). Central to this approach is the reader; other contributing variables to the reader’s response to the text include the text, the activity of reading, the teacher, the context in which the text is written and read, the reader’s prior knowledge, and the surrounding sociocultural influences. In short, this approach acknowledges, values, and supports the use of a variety of approaches and methodologies as are appropriate for the individual needs of the reader. One size does not fit all.

The term *transactional* was first introduced by Dewey and Bentley (1949) in their treatise to remove the use of the word ‘interaction’ to describe causal relationship with ‘transaction’ which suggests “mutual and reciprocal” relationships. This change more accurately describes the scaffolding in the constructivist approach used to scaffold comprehension between the reader, teacher, and other students. Rosenblatt (1978) used the same term to describe the event of reading she labeled “transactional theory of the literary work”. Rosenblatt noted that when readers read a text and consult with one another, greater understanding is constructed between members of the group than would likely otherwise be developed by the individual reader. Likewise, the teacher can guide such discussion with the reader to negotiate meaning from the text interpersonally. The goal of this approach is to create readers who will self-select and implement these strategies appropriately for each text they read. Rosenblatt (1985) describes this process as follows:
Instead of … the dualistic, mechanistic, linear, interactional view, in which the text and the personality of the reader … can be separately analyzed with the impact of one on the other studied in a vacuum, we need to see the reading act as an event involving a particular individual and a particular text, happening at a particular time, under particular circumstances, in a particular social and cultural setting, and as part of the ongoing life of the individual and the group. We can still distinguish the elements … not as separate entities, but as aspects of phases of a dynamic process, in which all elements take on their character as part of the organically-interrelated situation. (p. 100)

Yopp and Singer (1985) contend that the reading instructor actually mediates the task presented to the student (either linguistic or metalinguistic) while simultaneously guiding the student’s linguistic and cognitive skills as the reader acquires the skill. The instructor uses the reader’s understanding of words to facilitate the acquisition of smaller linguistic tasks such as phonemic manipulation. Continued support for this approach surfaced during the 1990s and continues to be an accepted and practiced approach to reading instruction (e.g., Baumann, Hoffman, Moon, & Duffy-Hester, 1998; Cowen, 2003; Spiegel, 1998; Vukelich & Christie, 2004).

Allington and Walmsley (1995) point out there is “no quick fix” to the diverse reading difficulties teachers see in their classrooms on a daily basis. Time has been one of the equalizers teachers of reading have relied upon. Time has provided them with countless numbers of studies in a wide variety of areas. Time has enabled the implementation of new strategies and techniques. Time affords researchers reflection and introspection of perceptions, theories, and approaches. Time guides our assessment of reading and the skills required to become an effective reader. Reading professionals continue to work toward identifying and implementing
the best practices of effective reading teachers throughout the world, and in doing so, continue to rely upon a dynamic body of literature which implicitly reminds them of the complexity of reading. At the risk of oversimplifying the very complex act of reading, this study considers Gough’s and Tunmer’s “simple view of reading” as a theoretical foundation for reading instruction and assessment, as well as intervention.

**The Simple View of Reading Theory**

The fields of special education, psychology, linguistics, and education have long struggled to isolate and identify plausible causes for reading deficits and disabilities. Most within these fields find common ground in the notion that successful reading relies upon the reader’s ability to accurately and automatically decode printed text into meaningful language units. In their *Simple View of Reading*, Gough and Tunmer (1986) argue reading is much more than the reader’s ability to decode—“read isolated words quickly, accurately, and silently” (Gough & Tunmer, p. 7). They acknowledge that to decode a text does not equate to an understanding of the text; rather, decoding enables to the reader to recognize and attach meaning to the word, sentences, and discourse of the text. In other words, reading is the product of the reader’s ability to decode words and linguistically comprehend their connected meaning, expressed in the equation $R = D \times C$.

Effective reading instruction is contingent upon effective assessment of students’ reading achievement. Historically, reading assessment has targeted several skills to measure reading achievement, e.g., word decoding, oral reading miscues, reading rate, oral prosody, and comprehension (Smith, 2002). The skills selected for reading assessment reflect the research of the time; therefore, an overview of reading assessment in the United States will provide the backdrop for the skills targeted by the instruments used in this study.
Reading Assessment in the United States

A Historical Look at American Reading Assessment.

Federal assessment of reading performance began in the early 20th century with reporting student performance and quickly escalated standardized testing, federally mandated programs, and high stakes testing. The progression of this approach to measuring students’ ability to read has resulted in a pedagogical paradigm shift from teacher-directed instruction to the implementation of a variety of technological tools, primarily computer-assisted instruction, in many of America’s public school classrooms.

Government Reports on Reading Performance.

In the preface of her original work, Smith (1965) reminds readers that “reading was the most important subject in our early American schools, and it has continued to be the most important subject all through the years of our national growth” (p. xv). A country’s investment in its human capital, specifically in its educational system and primary years of schooling, yields the greatest societal returns (Psacharopoulos, 1981). It is during these early years children learn to read and write. Public education has long felt the responsibility of preparing educated citizens, which likely led to the use of reading assessment to measure performance. In response to this sense of responsibility, the federal government created the U.S. Department of Education in 1867 “to collect information on schools and teaching that would help the States establish effective school systems” (ED.gov, 2010, ¶ 4).

The earliest reports of education performance were noted in reading research as early as 1937, which compared reading scores of children in grades two through six in 1937 to those of children in 1957 (Anderson, Hiebert, Scott, & Wilkinson, 1985). Although formal national reporting by states was not to emerge for three decades, several pieces of federal legislation
influenced the use of standardized testing as the primary measurement of student performance in reading. A brief review and timeline provides an understanding of the growing reliance upon standardized testing currently driving the American public education system.

Between 1958 and 1965, the Department of Education ratified two acts. The first education act the *National Defense Education Act of 1958* (NDEA, 1958). The act targeted the “fullest development of the mental resources and technical skills of its young men and women” (NDEA, p. 1581) using standardized tests for reading, math, and science as means of measuring the performance outcomes of students. On the heels of the NDEA, came the *Elementary and Secondary Education Act* of 1965 (ESEA, 1965). As a supplement to President Lyndon B. Johnson’s “War on Poverty”, the core of the legislation was to bring equitable access to education for the American children in poverty. Students’ performance on standardized tests measured the Act’s effectiveness.

Federal involvement in education resulted in two more pieces of legislation: the *Education for All Handicapped Children Act of 1975* (P.L. 94-142) (U. S. Congress, 1975) and A Nation at Risk: the Imperative for Educational Reform (NCEE, 1983). The *Education for All Handicapped Children Act*, or the *Individuals with Disabilities Education Act* (IDEA, 2004) required schools to provide all children identified with a disability in one of the fourteen approved categories a “free appropriate public education…and effective special education and related services to meet the needs of handicapped children” (p. 89 STAT.774). This act resulted in the creation of special education services. A call for educational reform during the Reagan Administration (1980-83) birthed the National Commission on Excellence in Education (NCEE, 1983) and delivered to the nation and the Secretary of Education in the report, *A Nation at Risk: The Imperative for Educational Reform*. The National Commission was formed by Secretary of
Education T. H. Bell and his “concern with ‘the widespread public perception that something is seriously remiss in our educational system’” (National Commission on Excellence in Education, p. 7). The Commission’s perception was that America’s “prosperity, security, and civility” were “at risk” because “our society and its educational institutions seem to have lost sight of the basic purposes of schooling, and of the high expectation and disciplined effort needed to attain them” (National Commission on Excellence in Education, p. 9). The report provided a list of dismal educational scores (about 13% of 17 year olds were functionally illiterate) and insinuated that the county needed to raise academic expectations by imposing higher standards of achievement.

The 1990s saw several pieces of new legislation. In 1990, the U.S. Department of Education established The National Center for Educational Statistics (NCES), which began more formalized recording, measurement, and reporting of data in its National Assessment of Educational Progress (NAEP) for states (NCES, National Center for Education Statistics, 2009). This department is also responsible for publishing The Nation’s Report Card. In 1998, the U.S. National Research Council’s Committee for the Prevention of Reading in Young Children was charged to “conduct a study of the comparative effectiveness of interventions for young children who are at risk of having problems learning to read” (National Academy of Sciences, 2010, ¶ 1). The Committee supported the importance and necessity of on-going reading assessment by reminding readers that “because the ability to obtain meaning from print depends so strongly on the development of word recognition accuracy and reading fluency, both the latter should be regularly assessed in the classroom” and that administrators and teachers to follow the results by “permitting timely and effective instructional response when difficulty or delay is apparent” (Snow, Burns, & Griffin, p. 7). Unfortunately, the most recent Nation’s Report Card 2007
(NAEP, 2007) indicated very little improvement in the reading performance of fourth and eighth grade students in the U.S. since the implementation of federally-mandated standardized testing.

**Government Reading Initiatives.**

In spite of several major educational reform movements over the past several decades, opponents of standardized testing and high stakes testing note that this approach has not improved the reading performance of American children. Womer (1984) suggests “lay persons and legislators who control education see testing-assessment as a panacea for solving our concerns about excellence in education” (p. 3); therefore, the reliance upon high-stakes testing continues in spite of little improvement. The first of these reform initiatives, *Becoming a Nation of Readers* (Anderson, Hiebert, Scott, & Wilkinson, 1985) reminded the nation that “reading is important for the society, as well as the individual” (p. 1). The initiative echoed the notion of educational investment and return (Psacharopoulos, 1981). *Becoming a Nation of Readers* (Anderson, Hiebert, Scott, & Wilkinson, 1985) is touted as the genesis of standards-based reform. The report called upon the nation (parents, teachers, schools) to help children “achieve their potential as readers” (p. 117) by investing in reading readiness, more appropriate texts, more reading, better teacher preparation, and better learning environments.

*Goals 2000: Educate America Act* (1994) charged the nation to prepare all children to reach their educational potential by the year 2000. Major components of the act included making certain of reading and learning readiness, increasing high school graduation rates, continued growth and excellence in math and science, educational equity, federally supported education programs, on-going professional development and preparation of teachers, and the establishment of national education standards. In spite of its lofty goals, the Nation’s Report Cards have reflected little improvement in reading performance. President William Clinton urged states to
participate in voluntary national testing as a means of improving the academic performance in American schools.

More recently, the *No Child Left Behind Act of 2001* (2002)—a reenactment of Johnson’s *Elementary and Secondary Education Act of 1965*—was enacted “to ensure that all children have a fair, equal, and significant opportunity to obtain a high-quality education and reach, at a minimum, proficiency on challenging State academic achievement standards and state academic assessments” (SEC. 1001.). Specific funds were earmarked under the Reading First grants to help schools provide reading instruction for students in kindergarten through third grade, professional development for teachers, financial support for reading assessment and diagnostics, development of appropriate instructional materials, and the support of literacy-based programs.

Despite the hopeful prediction that “the Administration’s [Reagan] push toward continued decentralization of federal education policy and reduction in the federal role is likely to prevail” (Clark, Astuto, & Rooney, 1983, p. 193), it remains clear that top-down federally mandated education policy is in place in America. Educational “fundamentalism tries to reduce complex phenomena to simple ones…as American education is being pulled by several forces that make it less than rational” (Goodman, 1989, p. 215). Moreover, this historical look at the major federal education legislation would be remiss without an examination of the *Report of the National Reading Panel* (NICHHD, 2000) and its influence on emergent literacy, reading assessment, high-stakes testing, and reading instruction.

**The Report of the National Reading Panel.**

The formation of the National Reading Panel (NRP) was a charge given to the Director of the National Institute of Child Health and Human Development by Congress in 1997. The Panel was to “assess the status of research-based knowledge, including the effectiveness of various
approaches to teaching children to read” (NICHHD, 2000, p. 1-1). The report articulated the panel’s conclusion, suggestions for implementing findings in classrooms, the development of a strategy for making the findings available to American schools, and a strategy for improving early reading preparation, if necessary.

Initially, the NRP used the National Research Council’s (NRC) report *Preventing Reading Difficulties in Young Children* (Snow, Burns, & Griffin, 1998) and several regional hearings to identify topics of greatest relevance. In their meta-analysis of reading research, much of which was rejected for a failure to meet research standards, the panel focused on five major constructs: alphabetic (phonics, phonemic awareness, word decoding), fluency, comprehension, teacher education and reading instruction, and computer technology and reading instruction. Although each construct is important to the teaching of reading, the scope of this study dictates only an examination of word decoding, word knowledge, oral reading fluency, and comprehension.

**Word decoding.** Word decoding, the skills a reader uses to “translate print into language” (Perfetti, 1984, p. 41) is acknowledged as one of the important components of reading by the NRP (NICHHD, 2000). This skill requires the reader to discriminate and identify graphemes, to attach phonemes to the graphemes, to attach language units to the grapheme patterns, and to construct meaning from the language meanings. Readers use a variety of skills to “convert letters into sounds or phonemes and then blend the sounds to form recognizable words” (NICHHD, 2000, p. 2-99) as they navigate text. Automatic word recognition enables readers to construct meaning, which results in comprehension of the text (LaBerge & Samuels, 1974). Perfetti (1984) states that “only a reader with skillful decoding processes can be expected to have skilled comprehension processes” (p. 43).
**Word knowledge.** Word knowledge requires the reader to understand the meaning of the words used in the text; more simply, this is an understanding of vocabulary. Vocabulary is extremely valuable in the reading process because the meaning of text is contained in the words that compose the text. Stanovich (1986) noted that the relationship between the reader’s vocabulary skills is often predictive of the reader’s reading skill and comprehension. His research suggested that the vocabulary of good readers was much higher than the vocabulary of struggling readers due to, in part, to the volume of reading conducted by stronger readers. Good readers read more than poor readers which results in more effective word recognition and exposure to a broader lexicon. Stanovich coined the phenomena of the “rich getting richer and the poor getting poorer” as the “Matthew effects”.

**Oral reading fluency.** Fluency, as defined by the NRP, is “the ability to read a text quickly, accurately, and with proper expression” (NICHHD, 2000, p. 3-5). The fluent reader automatically processes words and texts with little conscious effort. Echoing Allington’s (1983) claim that fluency was “the most neglected” reading skill, the panel confirmed that fluency received little attention in the research. Additionally, the panel noted the importance of automaticity in developing fluency. The reader’s effortless ability to recognize words appeared in LaBerge’s and Samuel’s (1974) work on information processing. They posited that automaticity in word recognition was a necessary processing skill for effective reading, fluency, and comprehension. In other words, the rate at which the reader neurologically processed the encoded messages of written language affected the reader’s ability to construct meaning from print. LaBerge and Samuel theorized that if certain component skills were automatic for the reader, such as alphabet recognition, tracking, and word recognition, less cognitive effort and conscious attention were needed to construct meaning from the text; the act of word recognition
was so natural it would not impair other reading-related processes (Posner & Snyder, 1975). Posner and Snyder assigned three criteria for automatic processes: “the process occurs without intention, without giving rise to any conscious awareness, and without producing interference with other ongoing mental activity” (p. 56). These criteria echo those ascribing to the information processing theory. This delineation is substantially different from oral reading fluency as defined for the purpose of this study. Whereas automaticity refers to processing abilities, fluency is a demonstration of one’s oral reading of text with accuracy, appropriate speed, and expression. The Panel’s findings concluded that cognitive processing is essential for reading and for reading fluency, as well as for comprehension.

Hasbrouck and Tindal (2006) provide oral reading fluency norms for students in the first-eighth grade to help teachers monitor students’ reading rates (See Table 1). The fall benchmarks provide classroom teachers with a guide to use for the identification of at-risk readers. The winter and spring benchmarks can be used for progress monitoring and screening of reading performance. Hasbrouck and Tindal remind educators that oral reading fluency is just one measure of reading achievement, much the same way body temperature is just one measurement of the body’s well being. They also recommend using “the 50th percentile as a reasonable gauge of proficiency for students” (Hasbrouck & Tindal, p. 642).
Table 1

*Second Grade Oral Reading Fluency Norms (Hasbrouck & Tindal, 2006)*

<table>
<thead>
<tr>
<th>Percentile</th>
<th>Fall WCPM</th>
<th>Winter WCPM</th>
<th>Spring WCPM</th>
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<td>90</td>
<td>106</td>
<td>125</td>
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<td>11</td>
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**Comprehension.** The Panel’s fluency findings also supported early studies in the importance of automatic word recognition in relationship to comprehension. The term comprehension originated during 1915-1925 (Smith’s *Period of Emphasis on Scientific Investigation in Reading*) when educators began to realize that reading involved much more than being able to identify letters and sounds and the pronunciation of words (Smith, 1963, 2002). Smith (1963) notes that the term comprehension “is just a big blanket term that covers a whole area of thought-getting processes in reading” (p. 25). The Panel (NICHHD, 2000) defined comprehension as “a cognitive process that integrates complex skills and cannot be understood without examining the critical role of vocabulary learning and instruction and its development” (p. 4-1). Regardless of differences in the definition of comprehension as related to reading, most agree it is a set of complex cognitive processes whereby the reader constructs meaning from the text while decoding and recognizing the words.

A body of research suggests that the more automatically and fluently a reader decodes text, the better his/her comprehension (Adams, 1990; Calfee & Piontkowski, 1981; Herman, 1985; Stanovich, 1986). Stanovich described several effects or consequences faced by struggling readers who are unable to properly and automatically recognize words and their meanings; he
called this the Matthew effects. This term came from the Biblical example quoted in Matthew 25:29, “For unto every one that hath shall be given, and he shall have abundance: but from him that hath not shall be taken away even that which he hath”. In other words, the rich shall become richer (the reader shall become better) and the poor shall become poorer (the struggling reader will continue to struggle and fall further behind). The cycle begins when readers who struggle with word recognition often times develop compensatory processing skills to accommodate deficits. The inability to rapidly recognize words severely impacts the reader’s exposure and acquisition of vocabulary, the quantity of engaged reading, and the enjoyment of reading. Those who have difficulties recognizing words read less. Those who read less have a diminished vocabulary, so they understand less. Because they understand less, they read less. This vicious cycle continues as the gap between normal reading development and actual performance increases, most often resulting in a lifetime of reading struggles. Juel (1988) found a very similar trend: poor readers in first grade usually remain poor readers in fourth grade. Poor word recognition also affects the reader’s ability to comprehend the text.

Few would argue that the “essence of reading” (Durkin, 1993) is being able to construct meaning from a variety of printed texts. It is much more than merely recognizing words (word callers). Comprehension is the reader’s ability to navigate a variety of texts while constructing meaning and understanding (Adams, 1990; Snow, Burns, & Griffin, 1998). The Panel established three constructs of comprehension: vocabulary, comprehension instruction, and proper preparation of teachers in comprehension instruction. They also emphasized the necessity of regularly assessing word recognition and fluency to support comprehension instruction.

An ongoing theme throughout the Panel’s report was the call for more frequent assessment. This call was answered and continues to be answered through the implementation of
informal assessment, progress monitoring, and the administration of standardized (high stakes) assessments.

**Reading Diagnostic Assessments.**

Early technological devices measured the physiological movements of the eyes during reading, such as the telebinocular, opthalmograph, metronoscope, the tachistoscope, and Harvard tapes (Smith, 2002). More recent diagnostic assessments have relied upon standardized tests and curriculum-based measurement as formative assessments to monitor reading achievement over time. In response to the National Reading Panel and the *No Child Left Behind Act of 2000*, the types of assessments administered have shifted from the measurement of eye movement to the measurement of reading skills such as word decoding, word knowledge, oral reading fluency, and multiple measures of oral and silent reading comprehension via standardized testing. Hasbrouck and Tindal (2006) classify reading assessments into four categories reflecting the purpose of the assessment; assessments are administered for the purposes of screening, diagnosing, progress monitoring, or monitoring outcomes. The most commonly used types for classroom reading assessments are those used for screening and progress monitoring. Assessing reading fluency and comprehension are generally measured using curriculum-based measurement and standardized reading assessments.

**Curriculum-based measurement.** Curriculum-based measurement (CBM) is one way for classroom teachers to assess students’ reading performance periodically throughout the school year. Originally designed as an alternative method of assessment at the University of Minnesota Institute for Research on Learning Disabilities, CBM incorporates components of informal assessment with components of standardized measurements as a means of measuring students’ basic skills (Deno, 1989, 1992; Shinn, 1989). It is a “time- and resource-efficient
classroom-oriented means of indexing academic standing at points in time and of quantifying progress over time” (Roberts, Good, & Corcoran, 2005, p. 305); whereas commercial standardized tests are quite costly (in terms of time, price, and lost instructional time), not designed to measure student growth, and not very applicable to classroom instruction. CBM is more school-teacher-student-instruction friendly (Good, Simmons, & Kame’enui, 2001). Its purposes and benefits include the following: (1) an effective and efficient tool to provide teachers with periodic data on individual students which can be used to measure the effectiveness of instruction and intervention (Deno, 1985; Roberts, Good, & Corcoran), (2) to provide data for “collaborative problem solving” (Deno, 1985), (3) to serve as a screening instrument for the identification and placement of at risk students (Deno, 1985), and (4) a reliable tool for gathering data to measure growth (Roberts, Good, & Corcoran). DIBELS is a common CBM used to measure basic reading skills in children K-sixth grade and will be discussed in greater detail later in the chapter.

**High stakes tests.** A wide variety of standardized reading assessments are available to schools and are frequently referred to as high stakes tests. High-stakes testing, as defined by Madaus (1988) is “a sample of items used to make inferences, decisions, or descriptions about people or institutions relative to some domain” (p. 34). The sample is used as a measure of accountability for a variety of decisions such as high school graduation, federal funding (which assures compliance with assessment reporting and standards-based instruction), tenure, or teacher accountability; outcomes carry ‘high stakes’ if they do not meet the required scores. As early at 1908, administrators such as Elwood Cubberly, dean of Stanford University’s education school, began calling for standardized testing “to estimate both the intellectual capacity of students and the effectiveness of teachers” (Allington & McGill-Franzen, 2000, p. 139).
Cubberly (1962) realized the purpose of standardized testing was to provide teachers with a measure of what their students were learning so their instruction could be modified; “it is a movement looking toward scientific accuracy in teaching” (p. 698). Madaus asserts that measurement-driven instruction has distorted how teachers teach and students learn, resulting in a deceptive picture of student knowledge. Initially, these assessments were simply used to measure minimum competencies; however, in recent decades the purpose of the assessments is not the measurement of competencies, but the measurement of world-class standards (Mehrens, 1984, 2002). Measurement-driven instruction currently fuels public education in the U.S., and not all agree with the shift.

Opposing this shift toward minimum standards and standardized testing are those who acknowledge the discriminatory nature of the tool toward at-risk students. Proponents of the ethic of critique have challenged the disenfranchising of marginalized populations in American education for over 40 years (Apple, 1982; Freire, 1970; Giroux, 1988; Ladson-Billings, 1995; Starratt, 1994). In the past insensitive word choice or figures of speech create barriers for students and adversely affect test results. Re-norming assessment instruments minimizes disenfranchising questions.

Anderson (1985) also asserts that assessment design reflects the purpose of the assessment and “if the assessments are “used primarily for curriculum advancement, [they] will look very different from those used for accountability” (p. 24). Not only will they look differently, but the outcome and impact of the assessment results will be very different (Mehrens, 1984, 2002). Many in the field of education provide an extensive list of negative results and/or consequences of high-stakes testing as used for accountability because of the discrepancy between the purpose and impact of standardized assessments (Cizek, 2001; Mehrens). Mehrens
contends there is very little reliable and valid research concerning the dangers and consequences of high stakes testing.

The body of research condemning high-stakes testing is plentiful; yet, not all researchers agree that ‘nothing good’ comes from such assessments. Cizek (2001) and Mehrens (1984, 2002) point out that although there is a body of works which proclaim dangers associated with such testing, many of the studies are unreliable, lack supporting data, and appear to be more anecdotal than research-based. Nevertheless, public education in the United States continues to promote a standards-based educational system assessed via high-stakes tests.

The government’s promotion of and reliance upon high stakes testing to measure student and teacher performance has changed the culture of education administration in America. Bates (1984) explains that organizational paradigms are “entities whose internal and external interactions are determined by the causal laws of behavioral and social science…[composed of] formal structures of thought…constituted by the language of rhetoric and practices of the organizational community” (p. 261). Organizations are dynamic, living entities that morph into cultures. The rhetoric, practices, and discourse determine “what is to constitute the culture of the organizational life that provides the dynamic of rationality, legitimation, and motivation” (Bates, 1984, p. 262) for the organization. Educational administration in the past century has seen a cultural shift from local autonomy to federal control over pedagogy, instruction, assessment, and funding. High-stakes testing has altered the culture of American schools, including schools in the state of Ohio.

Decades of research point to the importance of early assessment and response to students’ performance in early literacy skills. Ohio’s history of reading performance and diagnostic assessment tends to mirror federal legislation and reform. As mentioned earlier, A Nation at Risk
(1983) sounded an alarming message that American public education was ineffectively preparing its students for the growing global competition. The report assured citizens that intentional and cooperative efforts, higher standards, and more equitable education at the federal, state, local, and family level would surely improve the academic performance of its youth (National Commission on Excellence in Education, 1983). Standardized testing became the primary measurement of performance throughout the nation, and linked federal funds to the results.

In 2003, the State of Ohio implemented a standards-based framework for measuring student performance with the Ohio Proficiency Test (ODE, 2010c). Currently, the two high-stakes tests used in the state include the Ohio Achievement Assessments (replaced Ohio Achievement Tests) and the Ohio Graduation Test—implemented with the graduation class of 2007 (Ohio Department of Education, 2010b). The Achievement Assessment “measure[s] students on what they know and are able to do in mathematics, reading, science, social studies and writing, with administration to students spread out from third to eighth grade” (ODE, 2010d, ¶ 1). The Ohio Graduation Test is an “assessments aligned to Ohio’s Academic Content Standards in reading, mathematics, science, social studies and writing that students in high school must take to demonstrate proficiency before graduation from high school” (ODE, 2010b, ¶ 1).

The No Child Left Behind Act (2001) not only echoed the call for more assessment, as had been heard in previous pieces of legislation, but it also demanded more accounting and reporting on the part of states on student performance. States and other educational entities receiving federal funding selected or developed an annual assessment to measure each district’s academic performance goals and objectives. The data should reflect the district’s ability to demonstrate adequately yearly progress (AYP) for each student. Districts in the state are required
to administer The Ohio Achievement Tests in grades three, five, and eight; however, selection of the assessments used to monitor and report AYP lie with the districts. On-going formative assessment and data collection allow teachers to implement early, targeted intervention to struggling readers in an effort to close the growing literacy achievement gap of weaker readers.

**Literacy Achievement Gap**

Exposure to early literacy skills begins immediately after the birth of the child. As Adams (1990), Chall (1983), and Durkin (1966) point out, preparation for reading begins with the parents in the home years before teachers receive their students. Discussion on the gap in literacy achievement among populations is not new. Early studies (Juel, 1988; Stanovich, 1986) indicated that children with poor phonemic awareness and reading skills in first grade would likely remain poor readers in fourth grade. Struggling readers normally were unable to close the gap between their current reading skills and their target norm skills.

Ongoing research continues to support early identification and intervention for at-risk readers (Snow, Burns, & Griffin, 1998) and the notion that without early and intense intervention poor readers will likely not reach their current grade level of proficiency (Juel, 1988; Lentz, 1988; Neuman & Dickinson, 2001; Snow, Burns, & Griffin; Stanovich, 1986; Torgesen, 1998; Whitehurst & Lonigan, 2001). Early identification is most commonly determined using informal and standardized reading assessments. Intense intervention provides the greatest hope for scaffolding the students’ reading (Juel; Stanovich; Torgesen).

In addition to the student’s pre-emergent exposure to literacy as an influential factor in reading readiness is the child’s socioeconomic status. Research suggests the socioeconomic status of a student’s family is the most influential factor in the child’s acquisition of reading readiness skills (Blair, Blair, & Madamba, 1999; Bowey, 1995; Foster, 2001; Hart & Risely,
1995; Lee, Grigg, & Donohue, 2007; Levine & Eubanks, 1990; Roscigno, 2000; Roscigno & Ainsworth-Darnell, 1999; Schneider, Ennemoser, Roth, & Kuspert, 1999; Snow, Burns, & Griffin, 1998). Impoverished families frequently do not have literacy- or language-rich homes, access to literacy-support systems, resources, or parents with higher levels of education; therefore, their children normally enter kindergarten with a developmental disadvantage directly related to their emergent literacy skills. With direct, explicit intervention in phonics, phonemic awareness, fluency, and comprehension during kindergarten, first, second, and third grade, this gap can be nearly closed (Lundberg, Frost, & Peterson, 1988; Wagner, Torgesen, & Rashotte, 1993). Foster and Miller (2007) also confirmed the negative effects of poverty on literacy development and the importance of focused, explicit literacy intervention. Some purport that the gap between good and poor readers continues to grow over time unless weaker readers receive early, intense intervention. This widening gap leaves the good readers getting better and the poor readers becoming weaker; this theory is commonly referred to as the Matthew effects.

**Matthew Effects in Reading**

The literacy achievement gap Foster and Miller (2007) address extends the “Matthew effects” theory of the widening gap between the reading performance of poor readers and their peers over time without intense intervention. The term first emerged in science literature to describe the imbalance of recognition between more established researchers and emerging researchers (Merton, 1968). “In simpler terms, the Matthew effect consists in the accruing of greater increments of recognition of particular scientific contributions to scientists of considerable repute and the withholding of such recognition from scientists who have not yet made their mark” (Merton, p. 3). The principle of the ‘rich-getting-richer’ has also been referred to as a ‘positive-skew distribution’ in favor of those whose performance continues to grow based
on early advantages across a wide variety of domains (Walberg, Strykowski, Rovai, & Hung, 1984; Walberg & Tsai, 1983). The notion that readers who acquire the ability to decode and acquire reading ability early tend to spend more time reading, have greater exposure to printed materials, have greater vocabularies, and have greater understandings of syntax and discourse (Merton; Stanovich, 1986; Walberg, Strykowski, Rovai, & Hung; Walberg & Tsai).

Researchers suggest delayed intervention exacerbates the literacy gap in struggling readers in two specific areas: decoding and comprehension (Foster & Miller, 2007; Juel, 1988; Stanovich, 1986; Tunmer, Chapman, & Prochnow, 2003). Foster and Miller suggest immediate intervention in emergent literacy skills should begin with at risk students entering kindergarten to support normal reading readiness development. If intervention is neglected, students’ decoding skills acquisition is delayed until late third grade—nearly two years after children in the normal trajectory for reading acquisition—, and readers likely would not reach grade level performance. Struggling third graders perpetuate the literacy gap with underdeveloped comprehension skills. These findings support several previous notions concerning reading acquisition as well as Chall’s (1983) assertion that readers must acquire a lower level skill before moving to a more complex skill (e.g., readers in Stage 0 must master the skills in this stage before moving to Stage 1). Their findings also support the idea of overlap between stages of development, which Perfetti (1984) describes as a reading ability continuum. Chall (1983) supports a continuum of sorts as she reminds educators that arrival at Stage 5 may take a lifetime for some.

The gap that exists between the reading performance of normally developing readers and struggling readers is real. Unfortunately, few struggling readers rarely catch up to their peers (Juel, 1988; Lentz, 1988; Neuman & Dickinson, 2001; Snow, Burns, & Griffin, 1998; Torgesen, 1998; Whitehurst & Lonigan, 2001). The early years of reading instruction are very important to
the success of reading intervention (Pinnell, 1989; Snow, Burns, & Griffin). As Torgesen points out, “The best solution to the problem of reading failure is to allocate resources for early identification and prevention” (p. 32). However, educators continue to struggle with which interventions to utilize and when reading intervention should begin.

**Reading Intervention**

Reading researchers began investigating causes for reading disabilities and deficits during the nineteenth century (Smith, 2002). One of the first disabilities addressed by medical doctors was congenitalalexia (“word blindness”) (McCormick & Braithwaite, 2008; Smith). Although the reader with word blindness was likely of average intelligence and physiologically able to see, the disability prohibited the reader from developing automaticity in word recognition, therefore, the reader was blind to words. This theory was revisited and dismissed in the 1920s; nevertheless, readers lagging behind in their ability to acquire reading skills forced educators to modify the curriculum or to provide individualized remedial instruction as they tried to help the reader decipher written text (McCormick & Braithwaite).

The early 1900s were a time of significant growth in the field of reading. The study of struggling readers began diverging from students with “word blindness” to students who were not adequately progressing in their ability to read. Remediation shifted from the doctor’s office to the classroom. This appears to be the beginning of studying reading intervention (McCormick & Braithwaite, 2008; Smith, 2002). Augusta F. Bronner and Leta S. Hollingworth appear to be the earliest pioneers of remedial reading instruction (Smith). Bronner (1917) suggested moving away from labeling all struggling readers as victims of congenital word blindness; he urged researchers (primarily psychologists at this point) to look more broadly at struggling readers.
According to Bronner, “What is needed in every case is study of all mental processes, careful, thorough, and of as wide a range as possible, with thoughtful analysis of the results” (p. 88).

The administration of standardized tests resulted in the identification of an alarming number of lower-performing readers in need of remediation. Uhl (1916) first used the term ‘remedial reading’ in his work on the implementation of reading assessment data in remedial instruction. The assessment and diagnosis of reading disability also became more prevalent during this period. “The Clinic School”, the first clinical remediation center, began at the University of California-Los Angeles, in 1921. These educational clinics provided assessment and remedial instruction to struggling readers (Gray, 1922). The development of remedial reading programs and school-based remediation would not experience widespread acceptance and implementation until the 1950s-1960s.

The identification of causes for reading difficulties and disabilities in the 1950s directly influenced reading remediation. Purported causes included emotional disturbance, visual perception difficulties, neurological problems with organization, and a lack of phonics instruction. Respectively, remediation consisted of psychotherapy, medication, body management activities, and the abandonment of the whole word approach to reading (McCormick & Braithwaite, 2008; Smith, 2002). Some teachers revived the Language Experience Approach (using the students own language to teach reading) as a more authentic approach to both teaching and remediating reading.

Reading intervention, as defined by Tunmer (2008), encompasses the “instructional approaches and programs designed to either prevent or remediate persistent reading difficulties” (p. 299). Teachers provided early remedial instruction in classrooms either individually or in small groups, frequently grouped readers by ability, and differentiated their instruction to meet
the needs of the group (Smith, 2002). Weaker students were also paired with older, stronger
readers in multi-age classrooms for support and peer instruction (Smith). This model has
changed somewhat over the years. During 1950-1990, Readers identified with specific
disabilities were frequently pulled from their classrooms for instruction with the special
education teacher.

Intensive and early intervention has shown promise in helping readers close the
Vellutino, Scanlon, and Tanzman (1998) conducted a study which demonstrated the importance
of early non-psychometric reading assessment and intense intervention as a more appropriate and
effective approach to scaffolding the acquisition of reading skills in at-risk readers.

Another correlation Juel (1988) identified was the relationship between poor phonemic
awareness skills and reading performance. The predictive ability of phonemic awareness skills and
reading acquisition has since been supported with a broad range of research (e.g., Adams, 1990;
Brady & Shankweiler, 1991; Crowder & Wagner, 1991; Liberman, Shankweiler, & Liberman, 1989;
In summary, McCormick and Braithwaite (2008) conclude, “remedial and clinical reading
programs have followed the trends and practices of regular classroom, developmental reading
curricula” (p. 160).

Collecting data to measure and monitor instructional effectiveness and the AYP of all
students led to revisions of IDEA in 2004. This revision legislated, among several other changes,
the implementation of the Response to Intervention (RTI) model to monitor the effectiveness of
instruction being provided to students identified with special needs. RTI requires educators to
begin implementing interventions for students failing to perform within normal range the
moment the student begins lagging. Classroom teachers begin implementing interventions at the
classroom-level in an effort to remediate the student’s weakness to preclude the development of disability. The district in this study selected a group-administered instrument, the Gates-MacGinitie Reading Assessment (GMRT), for their annual assessment, and the DIBELS assessment for progress monitoring.

According to Johnson, Mellard, Fuchs, and McKnight (2006), “progress monitoring is a set of assessment procedures for determining the extent to which students are benefiting from classroom instruction and for monitoring effectiveness of curriculum” (p. 2.1). Such monitoring began as a response to federal laws requiring data to support the effectiveness of instruction provided to students identified as having specific learning disabilities. In keeping with The Simple View of Reading (Gough & Tunmer, 1986), most current literacy assessments measure the reader’s ability to recognize or decode words and to construct meaning (comprehension). Both the GMRT and DIBELS measure components of word recognition and comprehension in addition to the reader’s oral reading of an unrehearsed text with accuracy, appropriate rate, expression, and understanding. Historically, teachers have measured the reader’s rapid word recognition in an intact text via oral reading. Meyer and Felton (1999) and others (Rasinski, Padak, Linek, & Sturtevan, 2001; Reutzel & Hollingsworth, 1993) assert, “The relationship of fluent oral reading and overall reading ability is supported by both empirical and clinical evidence” (p. 402).

Computer-assisted Instruction and Intervention

The use of technology to assist struggling readers in American reading instruction emerged in the 1930s (Dale, Finn, & Hoban, 1949). Dale, Finn, and Hoban warned readers, “audio-visual materials and devices should not be classified exclusively as ‘eye’ or ‘ear’ sense stimuli” (p. 253). Rather, they encouraged the reader to look beyond the obvious senses to a
deeper neurological integration of sensory-processing. Audio-visual aids “are modern technological means of providing rich, concrete experiences for students” (Dale, Finn, & Hoban, p. 253). Audio-visual aids included the use of filmstrips, instructional films, mock-ups or models, field trips, still photos, lantern slides, museum materials, graphs, the use of radio, and sound recordings. The integration of audio-visual aids in education seems to be an extension of the military’s success with this approach as they prepared and trained military members in very short amounts of time during World War II, as well as its success in industry.

Use of audio-visual materials, namely filmstrips, for training in the U.S. Army was quite successful during World War II. Synthesis of the studies revealed several consistent results, according to Dale, Finn, and Hoban (1949). Early work with film quickly revealed that importance of the audience in the effectiveness of film; an audience with sufficient background knowledge and understanding gleaned much more from instructional filmstrips than did the unprepared soldier (Dale, Finn, & Hoban). Intelligence and prior knowledge significantly impact the effectiveness of film. Limited studies conducted during this time reveal significantly better results with filmstrips as compared to the use of manuals or lecture supplemented with lantern slides (Dale, Finn, & Hoban). Mock-ups or training models also yielded successful results during this period. Miles and Spain (1947), after analyzing other studies, surmised that “all studies indicate general approval of extensive employment of training aids. . . Instructors further believe that movies and filmstrips shorten training time, result in greater learning, and stimulate interest and motivation” (p. 75-76). Miles and Spain also discovered that “returned veterans now in college and public schools overwhelmingly indorse a greater use of audio-visual aids than is now characteristic of civilian education” (p. 76).
The use of audio-visual instruction aids in industry was quite popular during wartime. The Office of Education produced most of these training films and conducted several studies on the use of college-university level filmstrips and films (Dale, Finn, & Hoban, 1949). The three most common findings of their research were that the use of films resulted in shorter training time, in more interest in classwork, and in successful use in secondary classes. In spite of these promising findings, the Office of Education later called for more research to determine how and why films seem to be effective, discover a deeper understanding of the production of effective educational films, and develop a deeper understanding of learning (Dale, Finn, & Hoban).

Four major studies reported the effectiveness and promise of using radio broadcasts and recordings as tools for instruction throughout the 1940s (Dale, Finn, & Hoban, 1949). Educators could not ignore the growing use and success of radio programs and broadcasts. After all, “the American people spend a great deal of time listening to the radio; in many cases their behavior is changed and guided by what they hear” (Dale, Finn, & Hoban, p. 284). This new media presented American educators with a pressing challenge: to create “discriminating, critical listeners—an absolute necessity for the survival of our democracy in the Atomic Age” (Dale, Finn, & Hoban, p. 284). The visual and auditory media expansion and influence over American school children could not be overlooked or ignored.

Computer-assisted Reading Instruction

Technological growth continued throughout the 1950s. Gray (1961) predicted that the use of such tools as “filmstrips, films, recordings, and other devices” (p. 27) would see an increase in American classrooms as “the tremendous expansion in knowledge and the marvelous technological developments which are changing the ways of man everywhere” (p. 26) forced teachers to prepare their students for the changing world. He went on to discuss the advantages
and disadvantages of applying such technology to reading instruction. Technology could provide
the following advantages: (a) prevent readers from repeating reading errors, (b) allow for the
modification of reading passages and activities to promote reading growth, and (c) students could
monitor and administrate their reading instruction rather than the teacher. However, Gray warned
that such devices were incapable of scaffolding the child’s reading to higher levels of thinking,
such as analysis, evaluation, or imagination and should not be relied upon for instruction in these
areas.

Computer-assisted reading instruction (CARI) did not emerge until the 1960s in America.
The first scientific small-scale report of CARI using The Stanford Study model was conducted in
1964-65 (Atkinson & Hansen, 1966). The study demonstrated how the use of CARI allows
young readers to progress at their own pace using materials, skills, and benchmarks specifically
designed for the child. Twelve five-year-olds received fifteen 30-minute daily sessions. “Even
during this very short period of training it was clear that the children demonstrated marked
variation in their learning and retention behaviors [emphasis added]” (Atkinson & Hansen, p.
20). These results reflected previous outcomes from mathematics CAI. Atkinson and Hansen
acknowledge “the problem of developing a theory that will predict conditions under which a
given instructional procedure optimizes learning [emphasis added]” (p. 22); this continues to be
a challenge for educators.

In the National Reading Panel’s “Report of the Subgroups” (NICHD, 2000), research
regarding CARI was scarce throughout the late 20th century for a variety of reasons. Primarily,
many in the field of reading were not convinced of the efficacy of integrating technology into
reading instruction. Reading instruction in America, as noted earlier in the chapter, was
historically people-based because of the complexities of the reading process and subsequent
inter-related skills. Early computers were incapable of measuring and assessing skills such as prosody and oral reading fluency. Likewise, the relevance of technology in reading and education remained suspect. Early objections also included the prohibitive cost for early computers.

The Panel selected 12 studies to examine; all reported positive results after implementing CARI. Six of the studies addressed “the addition of speech to computer-presented text”, two studies “examined the effects of vocabulary instruction”, two studies “looked at word recognition instruction”, and the final two studies “investigated comprehension instruction” (NICHHD, 2000, p. 6-1-6-2). The Panel suggested ongoing research in the areas of incorporating speech with text, hypertext, and incorporating writing and reading instruction.

The use of computer-assisted reading instruction for children with dyslexia demonstrated some success in the early 1980s (Thompson, 1984). Thompson noted several benefits associated with using computers to create an “individually adapted curriculum-based approach” (Reason & Boote, 1994). Some benefits include the ability of the software to provide immediate feedback, the ability of the student to progress at a pace that is appropriate for the child, the ability of the program to provide objective, predictable feedback that may actually increase student motivation to read, and the ability of the program to store and track student performance. These benefits assist the teacher in providing on-going instruction and assessment of struggling readers. Similar positive results were noted when computer-based remediation was used with at-risk students in kindergarten (Mioduser, Tur-Kaspa, & Leitner, 2000). One treatment group used a computer-based program, the other used only text and printed materials, and the control group received instruction from the classroom teacher. The group receiving computer-based intervention scored
significantly higher in six of the eleven early literacy tasks (e.g., phonological awareness skills, word recognition, letter naming).

Some disadvantages noted by Thompson in 1984 are not as relevant in 2010, such as the poor quality of speech used in the software and the program’s ability to recognize speech (which is less of an issue with the development of voice recognition software) and the reliance upon written instructions (current programs feature oral instructions). However, Thompson was concerned about the lack of human contact and the ability of the teacher to observe and modify instruction as they observed the student during remediation, which remains a valid and relevant concern, particularly for children with disabilities.

**Computer-assisted Instruction and Students with IEPs**

The Individuals with Disabilities Education Improvement Act of 2004 identifies 12 categories that adversely affect the child’s educational performance under which a student may receive services and an Individualized Education Plan (IEP). The categories are as follows: autism, deaf-blindness, emotional disturbance, hearing impairment (including deafness), mental retardation, multiple disabilities, orthopedic impairment, other health impairment, specific learning disability, speech and language impairment, traumatic brain injury, and visual impairment (including blindness) (U.S. Congress, 2004). The scope of this study focuses on the effectiveness of CARI for students with reading or learning disabilities primarily in the areas of word decoding (phonologically and orthographically), word knowledge, comprehension, and primarily, oral reading fluency.

Word decoding is one of the most important skills in learning to read. “Proficient reading depends on an automatic capacity to recognize frequent spelling patterns visually and to translate them phonologically” (Adams, 1990, p. 293). Word decoding, or word recognition, requires the
reader to examine the printed word both phonologically and orthographically. Phonological awareness is the reader’s ability to recognize and manipulate various components in the English language such as sounds, syllables, words, phrases, sentences, and paragraphs (Adams). This awareness provides the base for the skill subset called phonemic awareness. Phonemic awareness is demonstrated by the discrimination, identification, and manipulation of individual discrete sounds, or phonemes (Adams). These skills are developed as the reader first encounters spoken language, then text. “Only those prereaders who acquire awareness of phonemes (the sounds to which graphemic units map), learn to read successfully” (Adams, p. 293). In other words, successful readers must be able to recognize the phonological properties of words in spoken language. This understanding supports the acquisition of learning the orthography (spelling system) of the language. Orthographic awareness enables to reader to decode print during reading and to encode language during the writing process. Therefore, “programs explicitly designed to develop sounding and blending skills produce better word readers than those that do not” (Adams, p. 293). Many struggling readers, as noted in Gough’s and Tunmer’s *Simple View of Reading*, struggle with word decoding and/or comprehension.

Computer-assisted instruction in spelling with older students has shown promise. Stevens, Blackhurst, and Stanton (1991) used time delay CAI with intermediate students in the fourth and fifth grades; spelling improvement was consistent with 80% of the students. MacArthur, Haynes, Malouf, Harris, and Owings (1990) compared the spelling performance of fifth and sixth grade students with learning disabilities using the traditional paper and pencil approach with those using CAI. The results were quite positive: students using CAI demonstrated higher performance and retention. Yet, not all research is so favorable. An earlier study using CAI with students with learning disabilities (McDermott & Watkins, 1983) showed
negligible difference in students’ spelling and math performance between conventional- and CAI-instructed students.

**Computer-assisted Instruction and Gender**

Stanchfield (1973) pointed out significant differences in the learning styles of young boys as compared to young girls. She noted that young boys have significantly more difficulty deciphering symbols, namely alphabetic symbols. Wilson, Burke, and Fleming (1939) found little difference in first grade test scores among boys and girls, but by the end of second grade 88% chance that girls would outperform the boys. Stroud and Lindquist (1942) found that girls outperformed boys in reading comprehension, vocabulary, word-study skills, and basic language skills in grades three through eight as measured by the Iowa Every-Pupil Basic Skills Testing Program. Early researchers attributed these academic differences to the structure of formal education. Formal instruction is more suited to girls’ interest and inclination to sit and focus on written text; whereas, young boys prefer work with their hands, pictures, and constructing. Gates (1961) attributed significant differences between reading performance to environmental factors. Gates felt as though “more girls than boys pursue a kind of life in which more respect, more incentives, and more opportunities for reading appear earlier and persist longer” and conversely, “more boys than girls may find little or no early need for learning to read” (p. 432). The same notions continue to drive research into helping boys become more engaged in reading.

Likewise, preference differences between boys and girls are linked to their biological differences in their study with kindergarten students (Colley, Hill, Hill, & Jones, 1995). Girls tend to have higher expressive language ability, while boys tend to be more active and competitive. Colley et al. noted that boys were more interested in how to play and navigate the game, whereas the girls were more concerned with the colors and the displays as opposed to the
navigational buttons. Passig and Levin (2000) observed that girls were much more concerned
about performing the task correctly and seemed to experience more anxiety when trying to
navigate correctly. However, both boys and girls seemed comfortable with computer-assisted
instruction.

Definite conclusions as to why the girls scored notably higher than did the boys are
difficult to surmise. Research seems to indicate that girls spend more of their time focusing on
the task and information rather than the movements of the game. It also seems to indicate that
Fast ForWord participants did not benefit from the CAI regardless of their gender.

**Fast ForWord Language Intervention**

Computer-assisted reading intervention programs provide schools with options for
providing students with reading remediation. Fast ForWord (FFW) is a computer-based
intervention collaboratively developed by Merzenich, Jenkins, Tallal, and Miller for Scientific
Learning Corporation (SLC) in 1997 to “build the learning capacity of the brain” (SLC, 2010b).
Through individualized games and exercises, and acoustically modified (reduced, then increased)
speech, the program claims to build and strengthen the reader’s auditory and temporal processing
of phonemes. SLC correlates their approach metaphorically to how the body responds and
transforms to physical training and exercise during fitness training. This neurological training
occurs in memory, attention, processing, and sequencing (SLC) as it “reinvents and
reconfigures” the brain. The brain’s ability to change and respond to learning is known as neural
plasticity (Konorski, 1948), brain plasticity, or cortical re-mapping. Neural plasticity is a modern
neurophysiology concept that posits the ability to create neurological stimulation (excitation) and
conditioning to change pre-existing neural pathways and connections (Konorski). Such changes
would be “the formation and multiplication of new synaptic junctions between the axon terminals of one nerve cell and the soma” (Konorski, p. 89).

Merzenich, Jenkins, Tallal, and Miller (Scientific Learning Corporation, 2010b) posit that 8-10 weeks of specific excitation in three primary neural sites using FFW will establish new neural pathways and remediate the negative or inappropriate plasticity associated with age-related cognitive decline (ARCD) and dyslexia. The remediation produces new, effective pathways and increases cognition. Developers believe that Goswami’s (1990) and Tallal’s (1980) findings which suggest a relationship between a child’s ability to rapidly discriminate acoustic information and speech language impairments (SLI), dyslexia, and reading deficits can be remediated with FFW’s approach to neural plasticity. FFW specifically targets the user’s memory, attention, processing, and sequencing abilities to increase cognitive capacity in the areas of phonological awareness, language, and reading (Scientific Learning Corporation, 2006). Consequently, targeting three primary cognitive processes the reader’s “phonological awareness, phonemic awareness, fluency, vocabulary, comprehension, decoding, syntax, and grammar” (Scientific Learning Corporation, 2006, p. 3) are strengthened resulting in improved reading performance.

FFW intervention pivots on three particular processing areas involved in the neurobiology of reading: the temporal lobe (auditory temporal processing), the frontal lobe, and the integration of information from the frontal and temporal lobes that occurs in the angular gyrus. The brain’s ability to discriminate sounds, develop phonological awareness, and decode words takes place in the left temporal lobe. The ability to produce speech sounds, develop oral reading fluency, appropriately use grammar, and to construct meaning from text (comprehension) takes place in the frontal lobe. The angular gyrus integrates these skills
The program uses acoustically modified speech to stimulate all three neural regions.

The technology used for FFW’s brain fitness allows the speed of delivered speech to the reader to be reduced to about 80 milliseconds (normal speech rate is about 40 milliseconds), also referred to by the researchers as acoustically modified speech to facilitate the clear neural representation and discrimination of phonemes. This adjustment slows the reception of phonemes so the student can begin to discriminate and perceive discrete phonemes. As the reader begins to acquire the ability to hear individual phonemes within in words, the program begins to target phonemes in syllables, then words. The higher levels of the program focus on the reader’s ability to recognize and identify word sounds within sentences, paragraphs, and other connected text (Scientific Learning Corporation, 2010). The program targets struggling readers from pre-kindergarten to post-secondary. This particular component also supports the auditory temporal processing theory, which suggests that struggling readers tend to have “an impaired perception of dynamic aspects in the auditory signal” (Boets, Wouter, van Wieringen, & Gherquière, 2007, p. 3).

Several theoretical assumptions support FFW. The first assumption is intensive intervention targeting negative neural pathways between core cognition and linguistic processes can improve reading ability (Scientific Learning Corporation, 2010a). Intensive intervention for FFW translates into 30-90 minute FFW sessions five times per week. Typical participation is between 4- and 16-week sessions depending upon the length of each session (short sessions of 30 minutes each day participate in intervention longer). The second premise is that acoustically modified speech technology can help “children recognize word sounds first, in isolated syllables, then in groups of sounds, words, and finally, sentences” (Scientific Learning Corporation, 2006,
p. 6) to rebuild language and reading skills. Some researchers (Goswami, 1990, 2001; Goswami & Bryant, 1990; Wagner & Torgesen, 1987) assert that poor or ineffective phonological processing is one of the primary causes for both language learning impairments and reading difficulties. Tallal and Piercy (1975) suggested children with language impairments who struggled with discriminating discrete phonemes were ineffective because of the speed of transmission of sounds. They determined the children were able to distinguish differences in phonemes, but the temporal auditory processing was not rapid enough.

Secondly, Tallal (1980) posited that children with reading impairments had a difficult time with temporal order judgment and nonverbal auditory perception and discrimination. She surmised that their general auditory temporal processing deficits were likely a primary cause for the misinterpretation and perception of discrete phonemes in children with reading difficulties. The slower delivery of phonemes facilitates more efficient and accurate auditory processing in the temporal lobe of the brain. Tallal, Miller, Jenkins, and Merzenich (1997) extended Tallal’s theory to include the notion that impaired readers likely had phonological processing deficits that stem from inaccurate auditory processing of nonverbal tones. However, the results are suspect since subjects were given two auditory tasks (discrimination of same/different and the ordering of phonemes), and she failed to evaluate and compare the error rate of the two tasks. Initial error rates were quite low and were not statistically significant. Bretherton and Holmes (2003) found no support for the relationship between the processing of speech sounds and reading deficits.

Moreover, Gillam, Loeb, Hoffman, Bohman, Champlin, Widen, et al. (2008) conducted a four-treatment six-week study on 216 children ages six through nine identified as having language impairments with contrary results to SLC’s claims. One group received FFW intervention and the remaining two treatment groups utilized a computer-assisted program
targeting auditory processing, memory, and language skills without the use of acoustically modified speech. Improvement in global language skills were reported for all four groups; however, no improvement in “general language skills or temporal processing skills” in children with specific language impairment (SLI) were noted for students receiving the FFW treatment. Such findings challenge the notion that acoustically modified speech is effective in the remediation of auditory processing deficits.

The third assumption of FFW is that “computers can be used to create interactive, adaptive learning interventions based on a neuroscience foundation that yield years of growth in as little as a few weeks” (Scientific Learning Corporation, 2010b, ¶ 1). FFW uses games and interactive exercises to capture the attention of the reader and target specific neural responses. The software also tracks individual performance that allows for adaptation to the specific needs of the reader.

Research indicates that at least 80% of children diagnosed with specific learning disabilities also have difficulty acquiring reading skills (Lyon, 1995). The “garden variety” struggling reader (Gough & Tunmer, 1986) is a reader who appears to be delayed in the acquisition of both word decoding or recognition and comprehension, whereas other researchers purpose that the disabled reader seems to have a “core phonological processing deficit” (Torgesen, Wagner, & Rashotte, 1997) which affects the readers ability to accurately and rapidly process phonemes. In either case, FFW neurological approach should provide promising gains.

However, Given, Wasserman, Chari, Beattie, and Eden (2007) reported less than promising results from a randomized controlled study using FFW intervention among middle school struggling readers. Students in the treatment groups received a combination of FFW intervention, SuccessMaker, or a combination of both treatments for 12 weeks. There was
interaction within-subjects, however, there was no interaction noted between subject groups. In other words, FFW intervention did not provide better results than SuccessMaker or classroom instruction.

**Summary**

In summary, it is clear that reading instruction in American public schools continues to experience changes and modifications in response to political, social, and educational needs. Politically, government officials acknowledge the importance of literate citizens and their impact on the nation. This concern fueled the establishment of free public education and the federal governments growing involvement in the education system. Trends in the field of reading have historically reflected the political priorities of the time. Colonial objectives focused on the spiritual preparation of the student as a means of civil preparation. This focus shifted to political preparation as the nation grew and began engaging in commerce. The industrial revolution required the educated to have an understanding of math and science to remain globally competitive. Currently, American schools are racing to prepare innovative students with 21st century skills. The political shifts have also shifted local autonomy from the school district to the federal government.

Federal legislation directly affects reading instruction at the local level. It mandates the use of standardized tests to measure the effectiveness of instruction and student reading achievement, pre-school intervention for at-risk children, adequate yearly progress for each student, and the early identification for children reading below grade level. The *No Child Left Behind Act* (2001) requires districts to minimize the literacy achievement gap between good and poor readers during the early years of reading instruction using Response to Intervention. While
not yet completely mandated by the government, local districts must also select the most effective and appropriate instructional methods for reading intervention.

Societal pressures to increase students’ reading achievement directly affect local administrators and teachers. Closing the literacy achievement gap requires resources, both human and fiscal. Tax-burdened community members demand fiscal responsibility while local districts search for ways to stretch their shrinking budgets and creatively utilize fewer faculty and staff members. Many are turning to computer-assisted instruction to supplement classroom instruction.

The need for research-based decision-making is critical during the concurrent eras of technology, standards-based education, and growing dependence upon high-stakes testing. Researchers and educators need to revisit the rich history of reading instruction in America as they look for the most effective reading methods of instruction and intervention. The use of computer-assisted instruction is growing, and it is time for researchers to try to determine “conditions under which a given instructional procedure [specifically computer-assisted instruction; emphasis added] optimizes learning” (Atkinson & Hansen, 1966, p. 22). This study examines the effectiveness of one of the most common reading interventions currently on the market, Fast ForWord.
CHAPTER III. METHODOLOGY

This chapter presents the methodology selected to answer the research questions related to the impact of the Fast ForWord (FFW) computer-based intervention on second-grade students’ reading achievement. The chapter addresses the research design, participants, instrumentation, data collection procedures, data analysis, and the assumptions and limitations.

Research Design

This study utilized a quasi-experimental research design to examine the impact of the computer-based reading program Fast ForWord on the reading achievement of second-grade students. The components of reading achievement studied include oral reading fluency, retelling fluency, word recognition, word knowledge, and comprehension. Performance data from a pre-existing database was collected from two sources: the DIBELS Oral Reading Fluency (ORF) and Retelling Fluency (RF) subtests and the Gates-MacGinitie Reading Tests (GMRT). Additional relationships between students with Individual Education Plans (IEPs) and gender were examined.

Participants

Participants for this study included 360 second-grade students (students using Fast ForWord, \( n=85 \); control group, \( n=275 \)) who attended one of four elementary schools in a district in Ohio adjacent to an urban area. Random assignment was not possible because participation and data were taken from intact classes. 

The participating district’s daily enrollment averaged 4,539 students and the approximate ethnic composition of the student body is as follows: 3.5% Asian/Pacific Island, 1.4% Black, 0% Native American, 3% Hispanic, 89% Caucasian, and 3% multi-racial. Approximately .5% of the students are from economically disadvantaged homes and about 8.8% of the students are
identified with a disability. The median income for families in the district is $48,677; the average district income is $78,233 (ODE, 2010e). Comparable-size schools within the state have similar demographics with the exception of Black students, which seem to be about 3% higher in comparable districts. Median incomes are very similar, while the average income in comparable districts is much higher—$85,943 (ODE, 2010e).

**Treatment and Control Groups**

Participants in the treatment group attended one elementary school. The building principal who selected the implementation of FFW is a very effective administrator and instructional leader in her building. She is committed to providing the faculty with sound, research-based instructional curriculum and support; her recommendations are highly regarded and eagerly embraced by her faculty. She created a very trusting environment and was quite successful in facilitating several previous curricular and instructional changes in the building. Classroom teachers willingly implemented the treatment based on her recommendation. The district basal reading curriculum continued to be the primary curriculum in the treatment group. Fast ForWord was a supplementary reading intervention selected specifically to target phonemic and auditory discrimination. FFW participants used the program for 30 minutes every day (5 days per week) in the school’s computer lab designated for FFW use for an entire school year. FFW games, online data intervention tool, incentive programs, the Language Series, and the Reading Series elements of FFW were utilized throughout the school year. Classroom teachers also used the district-adopted basal curriculum, reading intervention, and small group instruction, as needed.

Control group participants attended one of the remaining three elementary schools in the district. Classroom teachers conducted traditional, teacher-directed reading instruction using the
district basal reading curriculum. Whole group lessons typically lasted about 50 minutes and a 30-minute small group reading instruction time provided by classroom teachers. Students received teacher-directed small group reading intervention as opposed to the FFW intervention.

Participants from both groups also received additional reading intervention and small group instruction. Small group instruction reflected the students’ specific needs. The researcher was not informed as to which students received these services; the only data collected concerning students receiving additional services was related to students with IEPs.

Assessments were completed twice throughout the year. Participants completed the pre-DIBELS subtests during the first two weeks of September and the post-tests during May of the same academic year. The pre-Gates-MacGinitie Reading Tests were administered the first two weeks of September 2008 and again in mid-May (2009). Scores from the Gates-MacGinitie were extracted from the online scoring site. Classroom teachers administered both of the assessments to students, except for those students who received services from a reading teacher. In which case, the reading teachers administered the assessment to the students with whom they worked. Participants’ FFW scores were collected and recorded from the FFW website by the FFW coach and submitted to the district in an Excel spreadsheet. Participants’ demographic data were extracted from the districts’ database.

Materials

The treatment group used the commercial computer-assisted Fast ForWord learning product. Components used during treatment include Fast ForWord Language Basics, Fast For Word Language, Fast ForWord Language to Reading, Fast ForWord to Reading 1, and Fast ForWord to Reading 2. The program provides three to seven exercises targeting attention, auditory processing, memory, and language comprehension; student games; an incentive
program; an online data intervention tool; and language and reading programs designed to accommodate the student’s particular needs.

**Instrumentation**

Data were collected using two instruments, The Gates-MacGinitie Reading Tests (GMRT) Level 2 and the Dynamic Indicator of Basic Early Literacy Skills (DIBELS). The GMRT are paper-and-pencil, group-administered, norm-referenced reading diagnostic assessments (MacGinitie, MacGinitie, Maria, Dreyer, & Hughes, 2006). The instrument provides classroom teachers with a tool to measure students’ reading ability and achievement throughout the K-12 school experience and into adulthood. Assessment results can be use for instructional grouping, identification of students needing “special instruction” or “more advanced instruction”, “evaluating the effectiveness of instructional programs”, and as a tool for reporting and monitoring student reading performance (Riverside Publishers, 2010, ¶1). The second grade DIBELS (Good & Kaminski, 2002) ORF and RF subtests were administered in September 2008 and mid-May 2009. Both instruments provided quantitative data for this study.

**Gates-MacGinitie Reading Tests (GMRT)**

The Gates-MacGinitie Reading (GMRT) Test-Fourth Edition (MacGinitie, MacGinitie, Maria, Dreyer, & Hughes, 2006) Level 2 is a “group administered reading inventory test [which] assesses student achievement in [silent] reading” (para. 1). The Level 2 assessment is a general measurement of the reader’s early independent silent reading. The GMRT Level 2 contains two forms: form S and form T; Form S was administered as a pre-test and form T was administered as a post-test to all study participants. Students completed the assessment using paper and pencil. Each form has three subtests: Word Decoding, Word Knowledge, and Comprehension subtests, which provide the Reading Core score.
The Word Decoding subtest measures and evaluates the reader’s ability to recognize or decode words and contains 43 constructed response items. Each item includes a picture and four word or pseudoword options. The correct answer identifies the picture; the incorrect options are phonologically and orthographically similar to the correct answer and require the reader to discriminate each option to identify the correct response. A Kuder-Richardson Formula 20 (KR-20) was computed to determine reliability coefficients using computations from the Item Difficulty analysis. Reliability for the Word Decoding subtest was .94; this reliability illustrates the instrument’s ability to produce consistently similar result. In the fall 91% of the students completed the Word Decoding subtest and 97% completed it the following spring. This can be attributed to the identical design, length, format, and difficulty of Forms S and T (MacGinitie, MacGinitie, Maria, & Dreyer, 2002).

The Word Knowledge subtest measures the reader’s vocabulary ability and is designed similarly to the Word Decoding subtest. The subtest contains 43 items; each item contains a picture and four options. The reader must use semantic knowledge to select the correct response, rather than the phonological and orthographic knowledge used in the Word Decoding subtest. A Kuder-Richardson Formula 20 (KR-20) was computed to determine reliability coefficients using computations from the Item Difficulty analysis. Reliability for the Word Knowledge subtest was .92-.93; the validity of this assessment is high. High reliability reflects the instrument’s ability to generate consistent results. The instrument’s ability to produce valid results reflects its ability to accurately measure the skill being tested. In the fall 93% of the students completed the Word Knowledge subtest and 98% completed it the following spring. This can be attributed to the identical design, length, format, and difficulty of Forms S and T (MacGinitie, MacGinitie, Maria, & Dreyer, 2002).
The Comprehension subtest measures the reader’s ability to construct meaning from a variety of texts, including fiction, non-fiction, narratives, expository passages, and a variety of writing styles and discourse. Each passage has four sections, and three picture-answer choices follow each section. The correct option identifies the meaning of the corresponding text. A Kuder-Richardson Formula 20 (KR-20) was computed to determine reliability coefficients using computations from the Item Difficulty analysis. Reliability for the Comprehension subtest was .92. The validity of this assessment is high. Both measures reflect the instrument’s ability to consistently and accurately measure the targeted skills. In the fall 93% of the students completed the Comprehension subtest and 97% completed it the following spring. This can be attributed to the identical design, length, format, and difficulty of Forms S and T (MacGinitie, MacGinitie, Maria, & Dreyer, 2002).

A Kuder-Richardson Formula 20 (KR-20) was computed to determine reliability coefficients using computations from the Item Difficulty analysis. Reliability for the Core Total score was .97 (MacGinitie, MacGinitie, Maria, & Dreyer, 2002).

**Dynamic Indicators for Basic Early Literacy Skills (DIBELS)**

The Dynamic Indicators for Basic Early Literacy Skills (DIBELS) is a curriculum-based assessment tool that measures specific skills commonly associated with early literacy development and is designed “for repeated use to identify children with difficulty acquiring basic early literacy skills and to evaluate the effectiveness of interventions for these children” (Kaminski & Good, 1996, p. 215). Using Deno’s (1989) model for interval curriculum-based assessment, Kaminski and Good (1996) developed measures to assess phonological awareness, alphabetic principle and letter naming, vocabulary, comprehension, and oral reading fluency with cohesive text. The complete DIBELS instrument contains seven subtests complementary to the
five main reading constructs identified by the NRP; they are (1) ISF: Initial Sounds Fluency; (2) LNF: Letter Naming Fluency; (3) PSF: Phoneme Segmentation Fluency; (4) NWF: Nonsense Word Fluency; (5) ORF: Oral Reading Fluency; (6) RF: Retell Fluency; and (7) WF: Word Use Fluency. In addition to the subtests, DIBELS provides a selection of texts for daily or weekly progress monitoring in oral reading fluency.

Trained administrators give the DIBELS individually to students. In most districts, teachers, paraprofessionals, reading teachers and interventionists, administrators, and volunteers receive an 8-hour training session in preparation for the assessment. Scripted instructions to be used during the assessment are provided. The ORF subtest is a one-minute cold reading of the DIBELS passage. As the student reads the text, the administrator is responsible for conducting a running record of the student’s reading. The criterion-related validity coefficients for this subtest range from .62 to .95 (Dynamic Measurement Group, 2008). However, it should be noted that the validity of DIBELS comprehension assessment as measured by oral reading fluency has been called into question.

Adams (1990) asserted that the reader’s ability to accurately and swiftly translate printed text into spoken language (oral reading) was one of the most concrete expressions of skillful reading ability. The DIBELS ORF subtest uses rate (words read per minute; speed) and accuracy to measure the reader’s ability to recognize words. During the one-minute reading, the administrator monitors the student’s miscues (deviations from the text) such as substitutions (replacing a real word with a real word), mispronunciations (replacing a real word with a pseudoword), or omissions (leaving out a word or punctuation mark). If the reader recognizes a miscue and self-corrects the error within three seconds it is not marked as a miscue. Administrators record the number of words read correctly during the one-minute reading.
Normed oral reading rates and predictive risk for reading difficulties for each of the administrations are provided in Table 2 (Dynamic Measurement Group, 2008).

Table 2

*DIBELS Oral Reading Fluency (ORF) Subtest for Second Grade*

<table>
<thead>
<tr>
<th>Score: Status</th>
<th>Beginning of the Year Month 1-3 (September)</th>
<th>Middle of the Year Month 4-6 (January)</th>
<th>End of the Year Month 7-10 (April)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-25 words: At Risk</td>
<td>0-51 words: At Risk</td>
<td>0-69 words: At Risk</td>
<td></td>
</tr>
<tr>
<td>26-43 words: Some Risk</td>
<td>52-67 words: Some Risk</td>
<td>70-89 words: Some Risk</td>
<td></td>
</tr>
<tr>
<td>44+ words: Low Risk</td>
<td>68+ words: Low Risk</td>
<td>90+ words: Low Risk</td>
<td></td>
</tr>
</tbody>
</table>

**Data Collection Procedures**

Classroom teachers and building reading teachers (to students receiving small group instruction with a reading teacher) administered each assessment. The FFW coach compiled the DIBELS data from the online DIBELS site and the GMRT data from the data online site. The coach also collected the FFW data from the FFW online site. The FFW coach complied all data on an Excel spreadsheet. The school district organized the Excel spreadsheet and removed all identifiable information prior to transferring the data to the researcher. Statistical Package for Social Sciences (SPSS) was used to assess the impact of alternative remedial strategies for reading achievement amongst second-grade at-risk readers using the Fast ForWord (a computer-based) reading intervention program and a traditional (a teacher-based) classroom instruction and intervention approach.

**Research Questions**

1) Do Fast ForWord participants have significantly higher reading achievement than non-participants when controlling for pre-treatment differences?
2) Do Fast ForWord participants have significantly higher growth in reading test scores than non-participants?

3) Do reading test scores significantly differ based upon Fast ForWord participants with Individualized Education Plans (IEPs)?

4) Do reading test scores significantly differ based upon Fast ForWord participants and gender?

**Data Analysis Procedures**

An initial ANCOVA was utilized to compare group differences in post-test scores of the Gates-MacGinitie subtests (Word Decoding, Word Knowledge, Comprehension, and Core Total) and DIBELS subtests (ORF and RTF) scores while controlling for pre-test scores. A variety of inferential techniques were used to examine the impact of Fast ForWord on reading achievement (See Table 3). Research Question 2 used a \( t \)-test of independent samples to examine group means of reading growth as measured by the GMRT and DIBELS assessments. Two-way ANOVA was conducted for Research Questions 3 and 4 that examined group differences (IEP, gender) in growth of post scores of FFW, GMRT and DIBELS.
### Table 3

**Research Questions, Variables, Data Analysis**

<table>
<thead>
<tr>
<th>Research Question (RQ)</th>
<th>Independent Variables (IV)</th>
<th>Dependent Variable (DV)</th>
<th>Data Analysis</th>
</tr>
</thead>
<tbody>
<tr>
<td>1) Do Fast ForWord participants have significantly higher reading test scores than</td>
<td>• FFW and non-FFW participants</td>
<td>Post-test scores (quant): Gates-MacGinitie:</td>
<td>ANCOVA</td>
</tr>
<tr>
<td>non-participants when controlling for pre-treatment differences?</td>
<td></td>
<td>• Word Decoding; Word Knowledge;</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Covariates: Pre-treatment scores for all participants</td>
<td>• Comprehension;</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>• Reading Core;</td>
<td></td>
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<tr>
<td>2) Do Fast ForWord participants have significantly higher growth in reading test</td>
<td>• FFW and non-FFW participants</td>
<td>Growth scores (quant): Gates-MacGinitie:</td>
<td>t-test of independent samples</td>
</tr>
<tr>
<td>scores than non-participants?</td>
<td></td>
<td>• Word Decoding; Word Knowledge;</td>
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</tr>
<tr>
<td></td>
<td></td>
<td>• Comprehension;</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Reading Core;</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>DIBELS</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• ORF;</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• RTF.</td>
<td></td>
</tr>
<tr>
<td>3) Do reading test scores significantly differ based upon Fast ForWord participants</td>
<td>• FFW and non-FFW participants</td>
<td>Post-test scores (quant): Gates-MacGinitie:</td>
<td>Two-way ANOVA</td>
</tr>
<tr>
<td>on Individualized Education Plans (IEPs)?</td>
<td>• IEP</td>
<td>• Word Decoding; Word Knowledge;</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Comprehension;</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Reading Core;</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>DIBELS</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• ORF;</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• RTF.</td>
<td></td>
</tr>
<tr>
<td>4) Do reading test scores significantly differ based upon Fast ForWord participants</td>
<td>• FFW and non-FFW participants</td>
<td>Post-test and growth scores (quant): Gates-MacGinitie:</td>
<td>Two-way ANOVA</td>
</tr>
<tr>
<td>and gender?</td>
<td>• Gender</td>
<td>• Word Decoding; Word Knowledge;</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Comprehension;</td>
<td></td>
</tr>
<tr>
<td></td>
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<td>• Reading Core;</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>DIBELS</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• ORF;</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• RTF.</td>
<td></td>
</tr>
</tbody>
</table>
CHAPTER IV. RESULTS

The results of the statistical analysis of this study will be presented in this chapter. This study focused on the effectiveness of the computer-assisted intervention Fast ForWord on reading achievement among second grade students. The data were analyzed by descriptive statistics, analysis of covariance, difference between means, and analysis of variance using the Statistical Package for Social Sciences (SPSS). Descriptive statistics for each assessment will be presented first, followed by the findings for each of the research questions.

Descriptive Statistics

Participants in this study included 360 second-grade students (students using Fast ForWord, \(n=85\); control group, \(n=275\)) attending a district adjacent to an urban area in Ohio. Of the participants in the control group 6.5% were on an Individualized Education Plan (IEP), and 9.4% of the treatment group participants were on IEPs. The gender composition of the study included 160 (44%) female and 200 (55%) male participants. Means, measures of variability, and standard deviations for the control and treatment groups for the pre-, post-, and growth-scores are shown in Table 4. The pre-DIBELS norms for Oral Reading Fluency are approximately at the 63rd percentile (\(M=66.24\)) of Hasbrouck’s and Tindal’s (2006) oral reading fluency norms; teachers are encouraged to use the 50th percentile as a desirable goal for fall assessment. The mean for post-assessment oral reading fluency was in the 71st percentile (\(M=111.09\)). Benchmark goals for the DIBELS Retelling Fluency have not yet been established (Dynamic Measurement Group, 2008).
Table 4

Descriptive Statistics for Reading Assessments

<table>
<thead>
<tr>
<th>Assessment</th>
<th>n</th>
<th>M</th>
<th>SD</th>
<th>Minimum</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-DIBELS Oral Reading Fluency</td>
<td>353</td>
<td>66.24</td>
<td>33.52</td>
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<td>192.00</td>
</tr>
<tr>
<td>Post-DIBELS Oral Reading Fluency</td>
<td>330</td>
<td>111.09</td>
<td>35.00</td>
<td>9.00</td>
<td>200.00</td>
</tr>
<tr>
<td>Growth Oral Reading Fluency</td>
<td>322</td>
<td>46.04</td>
<td>17.79</td>
<td>-4.00</td>
<td>102.00</td>
</tr>
<tr>
<td>Pre-DIBELS Retelling Fluency</td>
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<td>29.32</td>
<td>15.85</td>
<td>0.00</td>
<td>110.00</td>
</tr>
<tr>
<td>Post-DIBELS Retelling Fluency</td>
<td>329</td>
<td>53.99</td>
<td>20.71</td>
<td>7.00</td>
<td>114.00</td>
</tr>
<tr>
<td>Growth Retelling Fluency</td>
<td>313</td>
<td>25.45</td>
<td>18.65</td>
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<td>84.00</td>
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<td>Pre-GMRT Word Decoding</td>
<td>348</td>
<td>61.62</td>
<td>26.65</td>
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<td>98.00</td>
</tr>
<tr>
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<td>360</td>
<td>67.88</td>
<td>25.47</td>
<td>2.00</td>
<td>95.00</td>
</tr>
<tr>
<td>Growth Word Decoding</td>
<td>344</td>
<td>6.00</td>
<td>16.21</td>
<td>-68.00</td>
<td>66.00</td>
</tr>
<tr>
<td>Pre-GMRT Word Knowledge</td>
<td>348</td>
<td>64.57</td>
<td>27.18</td>
<td>1.00</td>
<td>99.00</td>
</tr>
<tr>
<td>Growth Word Knowledge</td>
<td>344</td>
<td>-0.17</td>
<td>14.68</td>
<td>-51.00</td>
<td>55.00</td>
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<tr>
<td>Pre-GMRT Comprehension</td>
<td>348</td>
<td>62.21</td>
<td>62.21</td>
<td>1.00</td>
<td>99.00</td>
</tr>
<tr>
<td>Post-GMRT Comprehension</td>
<td>360</td>
<td>58.89</td>
<td>23.56</td>
<td>2.00</td>
<td>98.00</td>
</tr>
<tr>
<td>Growth Comprehension</td>
<td>344</td>
<td>-3.44</td>
<td>19.94</td>
<td>-60.00</td>
<td>46.00</td>
</tr>
<tr>
<td>Pre-GMRT Total</td>
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<td>63.93</td>
<td>25.85</td>
<td>2.00</td>
<td>99.00</td>
</tr>
<tr>
<td>Post-GMRT Total</td>
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<td>1.00</td>
<td>99.00</td>
</tr>
<tr>
<td>Growth Total</td>
<td>344</td>
<td>1.44</td>
<td>12.06</td>
<td>-35.00</td>
<td>46.00</td>
</tr>
</tbody>
</table>

Results by Research Question

The focus of this study was the effectiveness of the Fast ForWord computer-based reading intervention on reading achievement; three supporting research questions were posed.

Inferential tests were calculated for each question at the .05 alpha level of statistical significance.

Following are the results for each research question.

Research Question 1

Do Fast ForWord participants have significantly higher reading achievement than non-participants when controlling for pre-treatment differences?

An analysis of covariance was conducted to determine the treatment effect on post-assessment scores among the Fast ForWord group while controlling for pre-assessment differences (see Table 5). ANCOVA results revealed that each covariate significantly adjusted
post-treatment scores, indicating that the Fast ForWord group had significantly lower scores than the control group prior to the treatment. After the significant covariate adjustments, the Fast ForWord group scored significantly lower than the control group on all post-assessments, except on the Post- Dynamic Indicator of Basic Early Literacy Skills (DIBELS) Oral Reading Fluency (ORF). Fast ForWord had the greatest negative impact on the DIBELS Retelling Fluency (RTF), partial $\eta^2=.051$, and the Gates-MacGinitie (GMRT) Core Total, partial $\eta^2=.039$.

Table 5

ANOVA Results for Covariate Adjustment and Treatment Effect after Covariate Adjustment

<table>
<thead>
<tr>
<th>Variable</th>
<th>Non-FFW Participants</th>
<th>FFW Participants</th>
<th>ANOVA Results for Covariate Adjustment</th>
<th>ANOVA Results for Treatment Effect after Covariate Adjustment</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n</td>
<td>Orig.</td>
<td>Adj</td>
<td>n</td>
</tr>
<tr>
<td>Post-DIBELS ORF</td>
<td>268</td>
<td>112.66</td>
<td>111.23</td>
<td>54</td>
</tr>
<tr>
<td>Post-DIBELS RTF</td>
<td>264</td>
<td>56.73</td>
<td>56.36</td>
<td>49</td>
</tr>
<tr>
<td>Post-GMRT Word Decoding</td>
<td>262</td>
<td>68.82</td>
<td>69.27</td>
<td>82</td>
</tr>
<tr>
<td></td>
<td>262</td>
<td>64.83</td>
<td>65.38</td>
<td>82</td>
</tr>
<tr>
<td>Post-GMRT Comprehension</td>
<td>262</td>
<td>59.80</td>
<td>59.84</td>
<td>82</td>
</tr>
<tr>
<td>Post-GMRT Total</td>
<td>262</td>
<td>66.38</td>
<td>66.81</td>
<td>82</td>
</tr>
</tbody>
</table>

Research Question 2

Do Fast ForWord participants have significantly higher than expected growth in reading achievement than non-participants?

A $t$-test of independent samples was conducted on the reading achievement growth scores between the Fast ForWord group and non-participants (Table 6). Growth scores were created by calculating the difference between post- and pre-assessment scores (post – pre). The non-FFW
group demonstrated significantly more growth on all but two assessments (DIBELS ORF and GMRT Comprehension). The non-FFW group still showed more growth on the GMRT Comprehension, but it was not statistically significant. In contrast, growth scores for the DIBELS ORF was nearly identical between the two groups.

Table 6

*t-test Results for Treatment and Control Group Differences in Growth Scores*

<table>
<thead>
<tr>
<th>Variable</th>
<th>Non-FFW Participants</th>
<th>FFW Participants</th>
<th>High Group</th>
<th>t</th>
<th>p</th>
<th>(r^2)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(n)</td>
<td>(M)</td>
<td>(SD)</td>
<td>(n)</td>
<td>(M)</td>
<td>(SD)</td>
</tr>
<tr>
<td>Growth DIBELS ORF</td>
<td>268</td>
<td>46.03</td>
<td>17.20</td>
<td>54</td>
<td>46.09</td>
<td>20.66</td>
</tr>
<tr>
<td>Growth DIBELS RTF</td>
<td>264</td>
<td>26.91</td>
<td>18.83</td>
<td>49</td>
<td>17.59</td>
<td>15.59</td>
</tr>
<tr>
<td>Growth GMRT Word Decoding</td>
<td>262</td>
<td>7.50</td>
<td>15.28</td>
<td>82</td>
<td>1.22</td>
<td>18.14</td>
</tr>
<tr>
<td>Growth GMRT Word Knowledge</td>
<td>262</td>
<td>0.81</td>
<td>14.97</td>
<td>82</td>
<td>-3.30</td>
<td>13.30</td>
</tr>
<tr>
<td>Growth GMRT Comprehension</td>
<td>262</td>
<td>-2.41</td>
<td>20.06</td>
<td>82</td>
<td>-6.76</td>
<td>19.31</td>
</tr>
<tr>
<td>Growth GMRT Total</td>
<td>262</td>
<td>2.77</td>
<td>11.99</td>
<td>82</td>
<td>-2.78</td>
<td>11.38</td>
</tr>
</tbody>
</table>

**Research Question 3**

Does reading achievement significantly differ based upon Fast ForWord participants with Individual Education Plans (IEPs)?

A two-way analysis of variance was conducted to investigate reading test scores of the FFW group with Individual Education Plans (IEPs). Descriptive statistics are presented by group indicate that students on IEPS scored much lower than those without an IEP (see Table 7).
Table 7

Descriptive Statistics for Fast ForWord Participants and IEP Groups

<table>
<thead>
<tr>
<th></th>
<th>Non-FFW</th>
<th></th>
<th></th>
<th>FFW</th>
<th></th>
<th></th>
<th>IEP</th>
<th></th>
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<th>FFW</th>
<th></th>
<th></th>
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</thead>
<tbody>
<tr>
<td></td>
<td>n</td>
<td>M</td>
<td>SD</td>
<td>n</td>
<td>M</td>
<td>SD</td>
<td>n</td>
<td>M</td>
<td>SD</td>
<td>n</td>
<td>M</td>
<td>SD</td>
</tr>
<tr>
<td>Post DIBELS ORF</td>
<td>257</td>
<td>114.77</td>
<td>32.63</td>
<td>49</td>
<td>113.39</td>
<td>27.50</td>
<td>18</td>
<td>80.78</td>
<td>41.37</td>
<td>6</td>
<td>25.50</td>
<td>13.17</td>
</tr>
<tr>
<td>Growth DIBELS ORF</td>
<td>250</td>
<td>46.61</td>
<td>17.27</td>
<td>48</td>
<td>46.61</td>
<td>17.27</td>
<td>18</td>
<td>38.00</td>
<td>14.25</td>
<td>6</td>
<td>18.33</td>
<td>8.26</td>
</tr>
<tr>
<td>Post DIBELS RTF</td>
<td>257</td>
<td>58.05</td>
<td>19.59</td>
<td>18</td>
<td>34.50</td>
<td>16.33</td>
<td>49</td>
<td>44.33</td>
<td>16.32</td>
<td>5</td>
<td>10.60</td>
<td>3.78</td>
</tr>
<tr>
<td>Growth DIBELS RTF</td>
<td>247</td>
<td>27.63</td>
<td>18.90</td>
<td>48</td>
<td>18.00</td>
<td>15.49</td>
<td>17</td>
<td>16.52</td>
<td>14.60</td>
<td>1</td>
<td>-2.00</td>
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</tr>
<tr>
<td>Post GMRT Word Decoding</td>
<td>257</td>
<td>70.97</td>
<td>22.86</td>
<td>18</td>
<td>33.94</td>
<td>30.19</td>
<td>77</td>
<td>69.86</td>
<td>21.92</td>
<td>8</td>
<td>26.00</td>
<td>37.00</td>
</tr>
<tr>
<td>Growth GMRT Word Decoding</td>
<td>244</td>
<td>7.92</td>
<td>15.17</td>
<td>74</td>
<td>1.53</td>
<td>18.99</td>
<td>18</td>
<td>1.72</td>
<td>16.07</td>
<td>8</td>
<td>-1.63</td>
<td>5.83</td>
</tr>
<tr>
<td>Post GMRT Word Knowledge</td>
<td>257</td>
<td>66.94</td>
<td>21.31</td>
<td>18</td>
<td>30.78</td>
<td>21.77</td>
<td>77</td>
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<td>29.63</td>
<td>36.36</td>
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<tr>
<td>Growth GMRT Word Knowledge</td>
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<td>14.76</td>
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<td>-3.73</td>
<td>13.71</td>
<td>18</td>
<td>4.95</td>
<td>17.47</td>
<td>8</td>
<td>0.63</td>
<td>8.25</td>
</tr>
<tr>
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<td>18.65</td>
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<td>20.07</td>
<td>74</td>
<td>-8.04</td>
<td>18.12</td>
<td>18</td>
<td>-3.06</td>
<td>20.34</td>
<td>8</td>
<td>5.12</td>
<td>26.64</td>
</tr>
<tr>
<td>Post GMRT Core Total</td>
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<td>66.02</td>
<td>23.78</td>
<td>74</td>
<td>69.85</td>
<td>21.74</td>
<td>19</td>
<td>28.63</td>
<td>24.95</td>
<td>8</td>
<td>28.50</td>
<td>21.74</td>
</tr>
<tr>
<td>Growth GMRT Core Total</td>
<td>244</td>
<td>3.03</td>
<td>11.91</td>
<td>74</td>
<td>-2.89</td>
<td>11.82</td>
<td>18</td>
<td>-0.83</td>
<td>12.86</td>
<td>8</td>
<td>-1.75</td>
<td>6.30</td>
</tr>
</tbody>
</table>

Factorial ANOVA results are presented in Table 8. Interaction between the treatment and IEP was interpreted. If the interaction was significant, the main effect of Fast ForWord and IEP could not be interpreted or reported. Interaction between Fast ForWord and IEP was significant for the Post- and Growth scores for the DIBELS ORF, which indicates that the treatment and IEP work together to impact the ORF scores and suggests that Fast ForWord intervention impedes the reader’s ability to read orally with fluency for students on IEPs. For the remaining assessments, interaction was not significant. The main effect of Fast ForWord was only significant for the Post-DIBELS RTF. The main effect for IEP was statistically significant for
the Post-DIBELS RTF, Post-GMRT Word Decoding, Post-GMRT Word Knowledge, Post-GMRT Comprehension, and Post-GMRT Core Total.

Table 8

Factorial ANOVA Results for Fast ForWord and IEP Groups

<table>
<thead>
<tr>
<th>Interaction</th>
<th>FFW Participants</th>
<th>IEP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Post DIBELS ORF</td>
<td>F(1, 326)=11.33, p=.001</td>
<td>---</td>
</tr>
<tr>
<td>Growth DIBELS ORF</td>
<td>F(1, 318)=6.92, p=.009</td>
<td>---</td>
</tr>
<tr>
<td>Post DIBELS RTF</td>
<td>F(1, 325)=0.10, p=.308</td>
<td>F(1, 325)=14.21, p&lt;.0001</td>
</tr>
<tr>
<td>Growth DIBELS RTF</td>
<td>F(1, 309)=0.22, p=.639</td>
<td>F(1, 309)=2.20, p=.139</td>
</tr>
<tr>
<td>Post GMRT Word Decoding</td>
<td>F(1, 356)=0.43, p=.512</td>
<td>F(1, 356)=0.76, p=.385</td>
</tr>
<tr>
<td>Growth GMRT Word Decoding</td>
<td>F(1, 340)=0.18, p=.669</td>
<td>F(1, 340)=1.87, p=.172</td>
</tr>
<tr>
<td>Post GMRT Word Knowledge</td>
<td>F(1, 356)=0.05, p=.827</td>
<td>F(1, 356)=0.01, p=.982</td>
</tr>
<tr>
<td>Growth GMRT Word Knowledge</td>
<td>F(1, 340)=0.00, p=.989</td>
<td>F(1, 340)=1.73, p=.189</td>
</tr>
<tr>
<td>Post GMRT Comp</td>
<td>F(1, 356)=0.84, p=.361</td>
<td>F(1, 356)=0.14, p=.709</td>
</tr>
<tr>
<td>Growth GMRT Comp</td>
<td>F(1, 340)=2.46, p=.118</td>
<td>F(1, 340)=0.08, p=.777</td>
</tr>
<tr>
<td>Post GMRT Total</td>
<td>F(1, 356)=0.02, p=.889</td>
<td>F(1, 356)=0.14, p=.712</td>
</tr>
<tr>
<td>Growth GMRT Total</td>
<td>F(1, 340)=0.90, p=.343</td>
<td>F(1, 340)=1.68, p=.196</td>
</tr>
</tbody>
</table>

Results suggest that generally the FFW treatment did not contribute to significant growth in overall reading achievement for students without an IEP. The results for students with an IEP in the treatment group showed growth only in the Growth GRMT Comprehension assessment. Non-FFW participants demonstrated more growth than participants in every other area of growth. The results suggest that Fast ForWord remediation for students with an IEP in the remediation is not effective. With the exception of Growth GMRT Comprehension, the control group with and without an IEP scored significantly higher in every measure.

Research Question 4

Does reading achievement significantly differ based upon Fast ForWord participants and gender?
A two-way analysis of variance was conducted to investigate reading test scores of the FFW group and gender; the descriptive statistics are reported in Table 9. Concerning growth, female non-participants demonstrated moderately more growth than did participants in the DIBELS ORF, GMRT Word Knowledge, Comprehension, and Core Total subtests, and significantly more growth in the DIBELS RTF and GMRT Word Decoding subtests. Male participants in the control group demonstrated slightly more growth in the DIBELS ORF and GMRT Core Total than did non-participants. Non-participant males showed significantly more growth in the DIBELS RTF, GMRT Word Decoding, and GMRT Comprehension.

Table 9

Descriptive Statistics for Fast ForWord Participants and Gender

<table>
<thead>
<tr>
<th></th>
<th>Female</th>
<th>Male</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Non-FFW</td>
<td>FFW</td>
</tr>
<tr>
<td></td>
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<td>M</td>
</tr>
<tr>
<td>Post DIBELS ORF</td>
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</tr>
<tr>
<td>Growth DIBELS ORF</td>
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</tr>
<tr>
<td>Post DIBELS RTF</td>
<td>121</td>
<td>60.29</td>
</tr>
<tr>
<td>Post GMRT Word Decoding</td>
<td>119</td>
<td>71.74</td>
</tr>
<tr>
<td>Growth GMRT Word Decoding</td>
<td>115</td>
<td>9.23</td>
</tr>
<tr>
<td>Post GMRT Word Knowledge</td>
<td>119</td>
<td>66.28</td>
</tr>
<tr>
<td>Growth GMRT Word Knowledge</td>
<td>115</td>
<td>0.76</td>
</tr>
<tr>
<td>Post GMRT Comp</td>
<td>119</td>
<td>64.66</td>
</tr>
<tr>
<td>Post GMRT Core Total</td>
<td>247</td>
<td>66.02</td>
</tr>
<tr>
<td>Growth GMRT Core Total</td>
<td>119</td>
<td>70.24</td>
</tr>
</tbody>
</table>
Factorial ANOVA results, presented in Table 10, showed no interaction between FFW and gender for any of the assessments. Fast ForWord had a significant effect on Post-DIBELS RTF, Growth-DIBELS RTF, GMRT Growth Word Decoding, GMRT Growth Word Knowledge, and Growth GMRT Core Total. Gender had a significant effect on Post-DIBELS ORF, Post-DIBELS RTF, Post-GMRT Comprehension, and Post-GMRT Total.

Table 10

*Factorial ANOVA Results for Fast ForWord and Gender*

<table>
<thead>
<tr>
<th></th>
<th>Interaction</th>
<th>FFW</th>
<th>Gender</th>
</tr>
</thead>
<tbody>
<tr>
<td>Post DIBELS ORF</td>
<td>F(1, 326)=0.80, p=.370</td>
<td>F(1, 326)=3.78, p=.053</td>
<td>F(1, 326)=8.68, p=.003</td>
</tr>
<tr>
<td>Growth DIBELS ORF</td>
<td>F(1, 318)=0.73, p=.395</td>
<td>F(1, 318)=0.01, p&lt;.940</td>
<td>F(1, 318)=0.52, p=.470</td>
</tr>
<tr>
<td>Post DIBELS RTF</td>
<td>F(1, 325)=0.05, p=.816</td>
<td>F(1, 325)=29.59, p&lt;.0001</td>
<td>F(1, 325)=6.39, p=.012</td>
</tr>
<tr>
<td>Growth DIBELS RTF</td>
<td>F(1, 309)=1.40, p=.238</td>
<td>F(1, 309)=10.50, p=.001</td>
<td>F(1, 309)=0.27, p=.606</td>
</tr>
<tr>
<td>Post GMRT Word Decoding</td>
<td>F(1, 356)=0.05, p=.832</td>
<td>F(1, 356)=0.97, p=.325</td>
<td>F(1, 356)=2.47, p=.117</td>
</tr>
<tr>
<td>Growth GMRT Word Decoding</td>
<td>F(1, 340)=1.36, p=.244</td>
<td>F(1, 340)=10.28, p=.001</td>
<td>F(1, 340)=0.13, p=.720</td>
</tr>
<tr>
<td>Post GMRT Word Knowledge</td>
<td>F(1, 356)=0.13, p=.720</td>
<td>F(1, 356)=0.04, p=.844</td>
<td>F(1, 356)=1.64, p=.201</td>
</tr>
<tr>
<td>Growth GMRT Word Knowledge</td>
<td>F(1, 340)=0.08, p=.779</td>
<td>F(1, 340)=4.95, p=.027</td>
<td>F(1, 340)=0.11, p=.743</td>
</tr>
<tr>
<td>Post GMRT Comp</td>
<td>F(1, 356)=0.77, p=.380</td>
<td>F(1, 356)=1.20, p=.275</td>
<td>F(1, 356)=16.23, p&lt;.0001</td>
</tr>
<tr>
<td>Growth GMRT Comp</td>
<td>F(1, 340)=1.27, p=.261</td>
<td>F(1, 340)=2.76, p=.098</td>
<td>F(1, 340)=0.93, p=.340</td>
</tr>
<tr>
<td>Post GMRT Total</td>
<td>F(1, 356)=0.01, p=.963</td>
<td>F(1, 356)=0.86, p=.354</td>
<td>F(1, 356)=6.00, p=.015</td>
</tr>
<tr>
<td>Growth GMRT Total</td>
<td>F(1, 340)=0.05, p=.833</td>
<td>F(1, 340)=13.99, p&lt;.0001</td>
<td>F(1, 340)=0.89, p=.348</td>
</tr>
</tbody>
</table>

**Summary**

This study sample included 360 second-grade students (students using Fast ForWord, $n=85$; control group, $n=275$) in a district adjacent to an urban area in Ohio. Participants with an Individualized Education Plan (IEP) in the control and treatment group comprised 6.5% and 9.4% of the population respectively. There were 160 (44%) females and 200 (55%) males in the study. An existing district database was used to locate and analyze the participants’ test scores.
Four research questions guided the study. A summary of the results is presented in Table 11. Results suggest that the Fast ForWord treatment was not successful in producing significant growth in reading achievement. The treatment group performed significantly lower on the DIBELS RTF, GMRT Word Decoding, GMRT Word Knowledge, GMRT Core Total than non-participants, while the control group demonstrated higher performance even after controlling for pre-assessment differences. The disparity was also evident in the effects of the treatment on students with an IEP. The control group demonstrated significantly more growth in reading achievement than the students in the FFW group, with the exception of the Growth GMRT Core Total. In general, the treatment did not appear to yield significant growth in students with or without an IEP, nor did it suggest promising growth for either gender.

Table 11

*Summary of Results by Research Question*

<table>
<thead>
<tr>
<th>Research Question</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>RQ 1</strong> - Do Fast ForWord participants have significantly higher reading achievement than non-participants when controlling for pre-treatment differences?</td>
<td>• FFW participants performed significantly lower on DIBELS RTF, GMRT Word Decoding, GMRT Word Knowledge, GMRT Core Total than non-participants.</td>
</tr>
<tr>
<td><strong>RQ 2</strong> - Do Fast ForWord participants have significantly higher than expected growth in reading achievement than non-participants?</td>
<td>• Non-participants had significantly more growth than FFW participants in DIBELS RTF, GMRT Word Decoding, GMRT Word Knowledge, and GMRT Core Total.</td>
</tr>
<tr>
<td><strong>RQ 3</strong> - Does reading achievement significantly differ based upon Fast ForWord participants on Individual Education Plans (IEPs)?</td>
<td>• Interaction: Post DIBELS ORF and Growth DIBELS ORF; non-participants with an IEP scored higher • Fast ForWord Effect: Post DIBELS RTF • IEP Effect: Post DIBELS RTF Post Gates Word Decoding, Word Knowledge, Comprehension, Core Total.</td>
</tr>
<tr>
<td><strong>RQ 4</strong> - Does reading achievement significantly differ based upon Fast ForWord participants and gender?</td>
<td>• Interaction: none noted • Fast ForWord Effect: Post-DIBELS ORF and Post-DIBELS RTF • Gender Effect: Post-DIBELS ORF and RTF and GMRT Core Total.</td>
</tr>
</tbody>
</table>
CHAPTER V. CONCLUSIONS AND RECOMMENDATIONS

A review of the study and its implementation for this quasi-experimental study on the effectiveness of the Fast ForWord computer-assisted reading intervention is presented in this chapter with a summary of the findings. Conclusions from the study will support a discussion for the pedagogical implications of this particular computer-based intervention program, research-based reading instruction and intervention, and literacy leadership at the building level. Final thoughts regarding the implications of the findings and reading research will conclude the chapter.

Review and Implementation of Study

Technological advances have changed the face of reading instruction (Edyburn, 2007). Early instruction and intervention was provided by the teacher, often in a small group setting until the advent of technology, however IDEA (2004) has paved the way for the inclusion of assistive technology in the discipline of reading. Changes through the years have included the use of filmstrips, tape recorders, televisions, video recordings, and most recently, computer software programs. Computer-assisted instruction (CAI) refers “to programs [or devices] that use technology to enhance reading achievement” (Slavin, Cheung, Groff, & Lake, 2008, p. 292). One primary advantage of CAI is that it enables students to receive remedial individual instruction at computer, rather than with the teacher, freeing the teacher to work with other students. Many computer-based programs collect on-going data, streamlining the data collection process. Most CAI programs have the ability to modify instruction to meet the student’s needs.

The early identification of students with reading difficulties is imperative for successful remediation (Scanlon, & Tanzman, 1998; Snow, Burns, & Griffith, 1998; Vellutino,). Research indicates that accurate assessment and identification of reading deficits coupled with immediate,
The purpose of this study was to investigate the effectiveness of Fast ForWord, a computer-assisted reading intervention. A comparison of instructional approaches can be found in Table 12. Eighty-five students attending one of four elementary schools in a district in Ohio adjacent to an urban area received supplementary Fast ForWord intervention. The students used FFW five days per week for 30 minutes. The control group received teacher-directed basal instruction for 50 minutes per day. Pre-assessments occurred during the first two weeks in September. All of the participants were individually administered the DIBELS ORF and RTF subtests by reading and classroom teachers and a group administration of The Gates-MacGinitie Reading Test was conducted in by classroom teachers. The treatment group received reading supplementation using the FFW computer-based program throughout the entire academic year. Post-assessments were administered to both groups in mid-May of the same academic year.

Table 12

*Instructional Design for Treatment and Control Groups*

<table>
<thead>
<tr>
<th></th>
<th>FFW Participants</th>
<th>Non-FFW Participants</th>
</tr>
</thead>
<tbody>
<tr>
<td>District Basal Curriculum</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Teacher-led Small Group Instruction</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Fast ForWord Computer Intervention</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Supplemental Reading Instruction</td>
<td>Yes</td>
<td>Yes</td>
</tr>
</tbody>
</table>
**Discussion of Research Findings**

Study results leave several unanswered questions concerning which students are most likely to benefit from FFW intervention, specifically those with an IEP. Since IEP details were not available to the researcher, an examination of the outcomes of intervention for specific populations may provide insight to those who would most benefit from a program which implements acoustically modified speech and temporal auditory processing intervention.

The research findings are organized by the research questions directing this study. A summary statement will be provided and followed by a more detailed discussion of the findings.

**Research Question 1**

Do Fast ForWord participants have significantly higher reading achievement than non-participants when controlling for pre-treatment differences?

Group means and standard deviations for the control and treatment groups for the pre-, post-, and growth-scores were calculated to examine group differences. Analysis of covariance (ANCOVA) compared the treatment and control group while controlling for any pre-treatment differences. ANCOVA results revealed that each covariate significantly adjusted post-treatment scores. After the significant covariate adjustments, the Fast ForWord group scored significantly lower than the control group on all post-assessments. This outcome challenges the temporal processing theory (Tallal, 1980) which is the theoretical framework of FFW. Temporal processing theory supports the use of acoustically-modified speech sounds to strengthen the discrimination of phonemes in the left temporal lobe FFW also implements the concept of brain plasticity with acoustically-modified speech to “build learning capacity and improve overall literacy” (SLC, 2006, p. 3). The program specifically targets “reluctant or struggling readers” (SLC, 2006, p. 1) claiming “one to two year reading gains in 8 to 12 weeks” (p.3).
Based on the other assessments, the results seem to indicate that a phoneme- and acoustically-modified speech-based intervention such as Fast ForWord may not be an effective approach for remediating reading achievement. Using a bottom-up or synthetic approach is helpful in learning the phoneme-grapheme relationship to accommodate implementation of phonics for spelling and decoding, but this approach to decoding is significantly slower than automatically recognizing larger phonograms or rimes (LaBerge & Samuels, 1974). Slow decoding and word recognition negatively impact the reader’s oral reading rate, which would account for little growth in the treatment group (LaBerge & Samuels; Rasinski, 2003; Snow, Burns, & Griffin, 1998).

FFW had the most negative impact on the DIBELS Retelling Fluency (RTF). Some caution should be exercised in the interpretation of data concerning the DIBELS RTF. This subtest has been criticized for the method it utilizes to measure the student’s ability to retell the passage. Retelling is measured by counting the number of words the child uses to describe the passage, rather than computing the accuracy and ability to comprehend the text (Good, Kaminski, & Dill, 2002). Proponents support its use to identify at-risk readers using basic components of reading (Hoffman, Jenkins, & Dunlap, 2009). However, several researchers have questioned the validity of DIBELS data, political posture, and its possible negative impact on reading instruction (Allington, 2005; Goodman, 2006; Manzo, 2005; Tierney & Thome, 2006). Much of the literature published concerning DIBELS lacks peer-review, rigor, and independent study. Additionally, DIBELS measures very specific components of reading, rather than assessing actual reading. Opponents to DIBELS warn that targeting instruction on isolated skills as opposed to providing authentic reading experiences can actually thwart reading acquisition (Allington, 2005; Goodman, 2006).
Farstrup (2002) and Rasinski (2009) note that there is more to teaching reading than instruction. “Reading instruction, in its finest form, contains components of both art and science” (Farstrup, 2002, p. 1). The science of reading is rapidly producing volumes of new insight into the neurology of reading, cognition, memory, and speech. More is being discovered about how the human brain manages to complete the complex process of visually decoding symbols, translating the symbols into phonemes, phonemes into words, words to phrases, phrases to sentences, and sentences into meaning. Therefore, caution should be exercised before assuming a cause and effect relationship between Fast ForWord and reading achievement.

**Research Question 2**

Do Fast ForWord participants have significantly higher than expected growth in reading achievement than non-participants?

A *t*-test of independent samples was conducted on the reading achievement growth scores between the Fast ForWord group and non-participants by calculating the difference between post- and pre-assessment scores (post – pre). The non-FFW group demonstrated significantly more growth on all remaining assessments, with the greatest growth in the areas of DIBELS RTF and GMRT Core Total. The Fast ForWord group demonstrated miniscule growth in the DIBELS ORF subtest than did the non-FFW group.

The lack of improvement noted in the treatment group may not have been significant because of the students’ specific reading deficiencies. Not all at-risk readers struggle on the phoneme level. A wide variety of reasons can be attributed to poor reading performance, phonemic discrimination being only one possibility. Likewise, struggling readers in the treatment group may not have struggled with auditory temporal processing. Although Fast ForWord implements exercises in attention, memory, processing, and sequencing, it is quite possible that
the participants in the treatment group were not deficient in these areas. Focus on discrete skills in the absence of the entire reading process could result in poor reading (Goodman & Goodman, 1979).

Students who struggle with comprehension may have deficits not addressed in the bottom-up approach used by Fast ForWord. It appears that only about 14% of readers who struggle with comprehension also struggle with phonological and phonemic processing deficits (Catts, Fey, Zhang, & Tomblin, 1999). Therefore, little growth will occur if readers with poor comprehension are receiving bottom-up intervention. On the other hand, significant research links poor comprehension to language deficits, verbal memory, attention, and inferential reasoning skills (Cutting & Scarborough, 2006). Considering these potential focus areas, it would seem likely that Fast ForWord participants would have exhibited some growth as measured by the GMRT Comprehension subtest.

Likewise, Cutting and Scarborough (2006) noted to isolate the contributions and influences of word decoding/word knowledge and oral language skills, it is prudent to measure reading comprehension—the goal of reading connected text—in a variety of ways. Typically, oral reading comprehension as measured by DIBELS Retelling Fluency is measured by the number of words the reader is able to speak in one minute; this assessment does not take into consideration the reader’s expressive language abilities or articulation speed. Other comprehension assessments measure the reader’s silent reading comprehension, which does not rely upon the reader’s expressive language abilities. Although Fast ForWord targets language processing, it does not target expressive language skills, which impact the reader’s oral reading fluency and retelling fluency.
Contrary to the findings of this study, in a MAPS for Learning Report (Scientific Learning Corporation, 2008), it was reported that “both the Fast ForWord group and the comparison group significantly improved in oral reading fluency…with the Fast ForWord group making higher gains than the comparison group of their peers” (p. 1) as measured by DIBELS and Reading Edge. The Reading Edge, a component of the Fast ForWord program, is a software program within the FFW program that evaluates “phonological/early reading skills, including phonological processing, phonological awareness, phonemic decoding, and letter-sound identification” (Scientific Learning Corporation, 2008, p. 3). Since Reading Edge evaluates primarily phonologically-based skills, the assessment picture is somewhat stilted. A broader evaluation of reading achievement may yield a much different picture. In the *Reading Edge Educator’s Guide* (SLC, 2001), two particular cautions are given concerning the interpretation of data retrieved from Reading Edge that appears to be surprisingly low. The guide (SLC, 2001) states, “Reading Edge is not intended to provide a formal diagnosis, nor does it test for all the possible conditions that might explain reading problems” and “normal variations in students’ basic reading skills are greatest in the early school years” (p. 40). No such cautions were offered for scores which seem surprisingly high.

It is also interesting to note that Reading Edge (Barbara at SLC, 2011) is no longer being used. A search through SLC’s results archives indicates this assessment was used from 1999-2008. Equally surprising is that no scientific data for validity and reliability were provided in the *Reading Edge Educator’s Guide* (SLC, 2001) or on the website. During personal communication with SCL (Barbara at SLC, 2011), the researcher was told such data does not exist.

Several significant differences were discovered after reviewing the MAPS report that may have contributed to the disparity in findings. The most glaring difference in the report was
the omission of an ANCOVA computation to allow for covariate adjustments and to determine the treatment effect on post-assessment scores among the FFW group while controlling for pre-assessment differences. This would have identified covariates requiring adjustment and would have provided a more accurate picture of growth. The second difference was the length of implementation of the intervention. The FFW participants used the program only during the fall of the 2006-2007 school year. This length of intervention is consistent with the publisher’s recommended program length of 8-12 weeks (SLC, 2010). The third significant difference in reporting is the assessment of the students. Students were assessed using only two instruments: DIBELS ORF and Reading Edge. According to SLC (2008),

Reading Edge is a software program for evaluating phonological/early reading skills, including phonological process, phonological awareness phonemic decoding, and letter-sound identification. The Reading Edge composite score reflects a student’s overall performance on the various phonological and reading tests in Reading Edge taking into account the relative importance of each test in predicting reading ability. (p. 3)

The composite score rendered by Reading Edge measure discrete phonological skills, as opposed to measuring larger constructs such as word identification, word knowledge, fluency, and comprehension. Phonological processes skills are just one component of the reading process. This myopic measurement of “reading ability” is at best short-sighted and at worst theoretically dangerous. Historically, reading teachers have seen the importance of teaching reading from a more holistic approach so as not to divorce word identification from comprehension. Although this group of students is different than the population used for this study, it is somewhat puzzling to see such stark difference since both studies were conducted in the same district.
Research Question 3

Does reading achievement significantly differ based upon Fast ForWord participants with Individual Education Plans (IEPs)?

Results suggest the treatment contributed to minimal growth in oral reading fluency and overall reading achievement for students without an IEP; however, the results for students with an IEP are not as promising. Fast ForWord remediation for students with an IEP in the remediation of retelling fluency, word decoding, word knowledge, comprehension, or overall reading achievement generally did not result in significant gains as measured by the instruments used in this study. With the exception of Growth-DIBELS ORF, Growth GMRT Comprehension, and Post-GMRT Core Total, the control group with and without an IEP scored significantly higher in every measure.

Some research suggests that Fast ForWord is successful in remediating reading skills with children identified as having a specific language disorder (Tallal, 1980; Tallal, Miller, Jenkins, & Merzenich, 1997; Tallal & Piercy, 1975). The acoustically-modified speech provided neurological support for the frontal cortex and angular gyrus as the reader’s temporal processing was strengthened. However, contrary research suggests that “a variety of intervention activities” (Gillam, Loeb, Hoffman, Bohman, Champlin, Thibodeau, Brandel, & Friel-Palti, 2008, p. 97) provide more development than the use of Fast ForWord alone, suggesting the effectiveness of a trained educator identifying the reader’s specific needs and adjusting the intervention or instruction. Perhaps this may be an example of the “art” of reading instruction and intervention. Each reader possesses unique strengths, weaknesses, and propensities related to motivation, interest, context, or attention which cannot be identified or addressed via CAI at this time.
The results are consistent with studies indicating the reader’s ability to rapidly read connected text is related to oral reading fluency and comprehension (Fuchs, Fuchs, Hosp, & Jenkins, 2001; LaBerge & Samuels, 1974). One reason students with IEPs may not have made significant growth using Fast ForWord is because Fast ForWord focuses on the phoneme, rather than on reading connected text. Repeated exposure to concentrating on the phoneme could result in an over emphasis of phoneme isolation, resulting in choppy, or dysfluent, oral reading.

Again, contrary to the current study, struggling second grade readers (second-graders reading at a rate slower than 44 on the Fall DIBELS ORF) in the MAPS Report (Scientific Learning Corporation, 2008) showed significant oral reading growth. MAPS struggling readers gained an average of 41 points as compared to higher performing students who only gained 32 points. It does not appear that MAPS conducted an analysis of covariance to account for pre-assessment differences. ANCOVA results for the present study revealed that each covariate significantly adjusted post-treatment scores. After the significant covariate adjustments, the Fast ForWord group scored significantly lower than the control group on all post-assessments. One wonders how an ANCOVA may have resulted in different findings for the MAPS Report.

**Research Question 4**

Does reading achievement significantly differ based upon Fast ForWord participants and gender?

Female non-participants demonstrated moderately more growth than did female participants in the DIBELS ORF, GMRT Word Knowledge, GMRT Comprehension, and GMRT Core Total subtests, and significantly more growth in the DIBELS RTF and GMRT Word Decoding subtests. Male participants in the control group demonstrated more growth in the post-
and growth-scores in all but three assessments: Growth DIBLES ORF, Post-GMRT Word Knowledge, and Growth GMRT Core Total than did FFW male participants.

The results indicate female FFW participants demonstrated no growth in reading achievement, which may indicate the use of reading CAI is ineffective for second grade females in this population. Conversely, the results indicate that female students experienced more growth as a result of traditional reading and small group instruction (Colley, Hill, Hill, & Jones, 1995). Male non-participants exhibited more reading achievement growth than did the FFW participants; FFW male participants scored slightly higher in oral reading fluency, word knowledge, and core total suggesting that CAI may be beneficial for some second grade boys.

**Conclusions**

Based upon the results and discussion, four specific conclusions emerged from this study. They are as follows:

1. Traditional, teacher-directed instruction results in greater reading achievement than the computer-assisted instruction of Fast ForWord;
2. Students with IEPs experience more growth in reading achievement when reading instruction is provided by a knowledgeable classroom or reading teacher;
3. Gender does not seem to be positively related to computer-assisted reading instruction; and
4. FFW instruction may actually decrease reading achievement in readers who do not have language-related learning deficits.

**Leadership Implications and Recommendations**

Admittedly, there are no easy answers concerning the reading achievement scores of children. However, the results of this study have several fiscal, instructional, and leadership
implications for administrators, principals, teachers, and struggling readers, primarily, the responsibility of accountability. Currently, administrators and classroom teachers are held to nearly unattainable standards of public transparency and accountability as a result of the implementation of *The No Child Left Behind Act of 2001* and the recommendations of The National Reading Panel. Marzano, Waters, and McNulty (2005) identify 21 responsibilities of the school leader and their relevancy to student achievement, many of which overlap and compliment other responsibilities. These responsibilities are very similar to those outlined by Cotton (2003) and others in the field of educational leadership. Several relevant to the conclusions of this study are Change Agent; Involvement in Curriculum, Instruction, and Assessment; and Resources as they are related to the school principal and administrators. The domains of financial, instructional, and leadership accountability will be considered in light of the outcomes of this study on the effectiveness of Fast ForWord computer-assisted reading intervention.

Marzano, Waters, and McNulty (2005) define the Change Agent as one who “is willing to challenge and actively challenges the status quo” (p. 42). The building principal and district administrators serve as change agents within their realms of responsibility. As such, effective change agents cultivate and nurture a symbiotic relationship with others to gain their trust and respect as the organization accepts and implements change. This type of transformational leadership (Burns, 1978) frequently creates strong loyalty and trust in the followers. Such was the case in this study.

The building selected as the treatment group had a very effective principal who acted as an instructional change agent. The principal created a very trusting environment and was quite successful in bringing several previous changes in the building, curricular and instructional.
When approached by the district to try the Fast ForWord intervention program, the principal presented the program, the research, and recommendations to the faculty and support staff. Their trust and confidence in the instructional decision-making skills the principal previously displayed resulted in building-wide buy-in. Moreover, the principal was willing to challenge the status quo of the remaining three buildings in the district who elected not to participate in the treatment.

Effective change agents are very valuable literacy leaders. Marzano, Waters, and McNulty (2005) describe Knowledge of Curriculum, Instruction, and Assessment as being “knowledgeable about current curriculum, instruction, and assessment practices” (p. 43).

Literacy leaders must stay abreast of current reading curriculum, instruction, intervention programs, and assessment in order to provide appropriate instruction for all students. Principals are the literacy leaders in their building (Elmore, 2000; Fullan, 2001). They must remain knowledgeable and informed of best practices in the aforementioned areas so they can guide teachers in decision-making situations.

As instructional leaders and change agents, administrators and principals can provide the needed support for specific reading intervention programs, specialists, and interventionists. Principals in exemplary schools reported that they acknowledged their responsibility as instructional leaders and realized the need to support literacy leaders and reading specialists and coaches in their buildings (Bean, Swan, & Knaub, 2004). The principal’s support of new reading programs, interventions, and assessments is essential for success. In this study, the administration and principals’ decisions to either adopt or reject the Fast ForWord program was a weighty matter. Adopting the program meant they were confident that this intervention would provide appropriate and beneficial intervention for all their students, including struggling readers. In this case, it also meant they were responsible for the one-time purchase this program, as opposed to
another program. Their accountability to the faculty, students, and public also extends to the allocation and distribution of resources. As the study indicates, traditional, teacher-directed instruction resulted in greater reading achievement than the computer-assisted instruction of Fast ForWord.

Local districts also bear the responsibility of providing “teachers with materials and professional development necessary for the successful execution of their jobs” (Marzano, Waters, & McNulty, 2005, p. 43). The findings of this study support the importance of prudently handling the district’s resources considering the importance of teacher-directed instruction for students with IEPs. The implementation of resources is necessary for building school capacity. Fullan (2000) adds that “Instructional improvement requires additional resources in the form of materials, equipment, space, time, and access to new ideas and to expertise” (Fullan, 2000, p. 64-65). Another resource allocation concerns the investment in professional development for teachers. The International Reading Association (2010), Standard 6 specifically addresses professional learning and leadership in lifelong learning. Professional development is crucial for effective classroom instruction (Fullan, 2000).

Allocation and investment of resources is especially relevant to this study. The purchase of the Fast ForWord program meant the district was denying the purchase of other resources in favor of the program. Perhaps literacy and instructional leaders in the district may want to re-evaluate how they can continue to reap some benefits from Fast ForWord. Clearly, the strength of this program lies with its ability to strengthen phonological skills. Selecting populations of students who might best be served by this targeted intervention may include students receiving speech-language services, hearing impairment, or other neurological impairments resulting in low phonological awareness. English Language Learners (ELL) throughout the district may also
find FFW beneficial during their acquisition of English phonemes. The FFW lab could be transformed into a language support lab for the district as well as the community. The returns from this initial investment could prove to be far more beneficial than originally speculated.

Looking forward, districts might want to explore the on-going investment returns related to reading and literacy professional development. As is seen throughout the history of reading instruction in America, the well-prepared teacher of reading is the most effective method of instruction (Darling-Hammond, 2000; NICHHD, 2000; Pressley, Wharton-McDonald, Allington, Block, Morrow, Tracey, Baker, et al., 1999). The National Reading Panel Report (2000) argued, “good teacher preparation can result in the delivery of instruction that leads to improvements in students’ reading comprehension” (p. 4-120). Darling-Hammond (2000) notes that the “NAEP (National Assessment of Educational Progress) analyses found that teachers who had had more professional training were more likely to use teaching practices that are associated with higher reading achievement on the NAEP tests” (p. 6). Allington (Allington & McGill-Franzen, 2000) echoes the importance of effective classroom instruction in producing good readers writing that

The most important variable in teaching reading, I believe, is the quality of classroom reading instruction, and that seems largely independent of the nature of the curriculum materials. It amazes me that it is only recently that we have begun to estimate the impact of access to high-quality teaching. (p. 143).

The results of this study support this finding. Administrators, building principals, and literacy leaders may want to consider investing in sound professional development for their teachers and paraprofessionals as the most effective means of providing students with or without IEPs appropriate and effective instruction.
Similar decisions concerning the most appropriate instructional approaches for teaching male and female students seem to fall back to well-trained teachers. Since neither gender exhibited substantially more growth with the FFW intervention, greater consideration should be given to investing in people.

The final conclusion of the study, FFW instruction may actually decrease reading achievement in readers who do not have language-related learning deficits, supports the importance of teaching reading from a transactional approach. As discussed in Chapter II, this approach is holistic and flexible. It involves inter- and intrapersonal communication, collaboration, and construction of meaning. Such communication between students and teachers is dynamic and organically produces the negotiation of understanding; such dialogue is impossible to replicate via computer-based intervention programs. The results of this study suggest that rich interpersonal transactions occurred between teachers and readers in the control groups. A knowledgeable teacher of reading understands the importance of scaffolding learning between the reader and the text, their peers, and the world. The teacher is also capable of spontaneous instructional modification and differentiation to meet the needs of individual students, neither of which can be duplicated technologically at this time with this program.

Currently, FFW and other computer-based instruction is unable to duplicate this language-rich interchange that takes place between teacher and student and may only be effective for a very finite population. Further research in FFW participants may provide greater insight into the most likely populations (e.g., students receiving speech-language services, students with hearing impairment, students with other health impairments resulting in phonological deficits, or English Language Learners) to benefit from the program’s unique application of acoustically-modified speech and neural pathway remediation. Perhaps, the
implementation of the Fast ForWord Language Program should be reserved for use in the remediation of children with specific language and phonological disabilities, rather than being used as a global intervention strategy. MAPS for Learning Reports (2008) states,

Fast ForWord Language software showed that an optimal learning environment and focus on early reading and cognitive skills resulted in dramatic improvements in the auditory processing and language skills of school children who had specific language impairments. (p. 1)

Such findings are obviously targeting a specific population—those with specific language impairments.

Concerning effective reading intervention, literacy leaders may better serve their students by investing in applicable professional development. The importance of well-trained reading teachers is paramount to reading achievement and to “the science and art of teaching reading”. Moreover, the financial output is a bit more reasonable than the one-time purchase of a program or software package. As Psacharopoulos (1981) reminds us, a country’s investment in its human capital, specifically in its educational system and primary years of schooling, yields the greatest societal returns. Teachers of reading in the early years need to be well-trained and equipped to provide the most effective reading instruction for their students. This is an investment with generations of immeasurable returns.

Future Research Opportunities

Greenfield (1981) noted that theoretical educational framework must be careful not to separate value, practice, common sense and administration from facts, theory, rationality, and education; for in doing so, administrators are crippled and ineffective. Accepting Greenfield’s assertion that administrators and instructional leaders must lead in a transformational manner,
American educational administrators need to explore several areas of literacy instruction in order to equip themselves as literacy leaders. Primarily, additional research on effective teachers will provide insight into how the “art of teaching reading” applies “the science of teaching reading”. It makes sense to approach reading from a transactional approach and use people to teach reading skills and to provide authentic reading experiences for struggling readers.

Another avenue of exploration is more collaboration between classroom teachers, reading specialists and interventionists, and speech language pathologists (SLPs). Reading is a language-based process; therefore, collaboration amongst scholars in the field of speech-language pathology would provide a more complete examination of the reading processes. It would be beneficial for SLPs to include literacy goals in their assessments of emergent reader receiving their services (Foster & Miller, 2007). This would enable dual strands of research to study the practices of struggling readers. Such collaboration could possibly facilitate early identification of language-related reading difficulties in struggling readers.

Although research supporting the need for early identification and intervention for at-risk readers is plentiful, further exploration of brain plasticity and the neurobiology of reading may provide missing links in reading intervention. “While there is evidence that humans are hardwired to listen and speak, reading and writing are not natural processes” (Fisher, Frey, & Lapp, 2009, p. 14). These processes are dependent upon neurological and biological systems, such as the visual cortex and occipital lobe, to work simultaneously. The primary functions of these brain structures are not reading, yet when the eye scans print, neurons begin firing to help the reading decode the text and construct meaning. Struggling readers experience misfires somewhere in the process; therefore, more neurobiological research is needed to isolate potential areas of dysfunction. Such research will “equip teachers to teach children … how to read, and we
believe this should begin early and through the most authentic and natural language-based ways” (Fisher, Frey, & Lapp, 2009, p. 15). Additional study on the Fast ForWord Language Program may determine which students would benefit most from activities that remediate faulty or slow neural pathways using acoustically-modified speech.

Educators and researchers must remember, “Reading instruction, in its finest form, contains components of both art and science” (Farstrup, 2002, p. 1). As the technology boom of the late 1940s threatened the traditional approach to teaching reading, Emmett Betts (1949) sounded an alarm for the need to prepare and equip teachers with more support and instruction in order that they might “discover individual needs and to provide the necessary differentiated instruction in reading” (p. 283) to their struggling readers. Betts understood the complexity of reading; let his words remind us that the most effective tools for reading instruction and intervention continue to be well-prepared, passionate teachers of reading. Let us never forget the personal expression of art each teacher of reading brings to his/her students as he/she teaches them to read.
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